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The Journal of HEREDITY

A monthly publication devoted to Plant Breeding Animal Breeding and Eugenics

FEBRUARY, 1919

Vol. X, No. 2

THE SYNTHETIC PRODUCTION OF WILD WHEAT FORMS

PRESENT CONDITION AND OPPORTUNITY OF THE AMERICAN GENETIC ASSOCIATION

SOME PRESENT ASPECTS OF IMMIGRATION

THE BREED IN POULTRY AND PURE BREEDING

BETTER AMERICAN FAMILIES—II

GOOD QUALITIES ARE CORRELATED

RACE MIXTURE IN HAWAII

ORGAN OF THE
AMERICAN·GENETIC·ASSOCIATION
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"An exact determination of the laws of heredity," says William Bateson, "will probably work more change in man's outlook on the world, and in his power over nature, than any other advance in natural knowledge that can be clearly foreseen."

To gain this knowledge is the object of the science of genetics, which proceeds, in practice, largely by means of plant breeding and animal breeding for the reason that heredity is less complicated in these organisms than in Man, and its operation can be more easily made out. The knowledge so gained finds its application in methods for the improvement of cultivated plants and domesticated animals and, most important of all, in the improvement of the human race through the science of eugenics, which was defined by its founder, Francis Galton, as "the study of agencies under social control that may improve or impair the racial qualities of future generations, either physically or mentally."

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NOTE

Instead of raising the price of membership, and in order to meet the requirements of the War Industries Board, and also because of the drafting of the whole Editorial Staff the July, August and September numbers have been dropped out for 1918. Vol. IX contains only 8 instead of 12 numbers.

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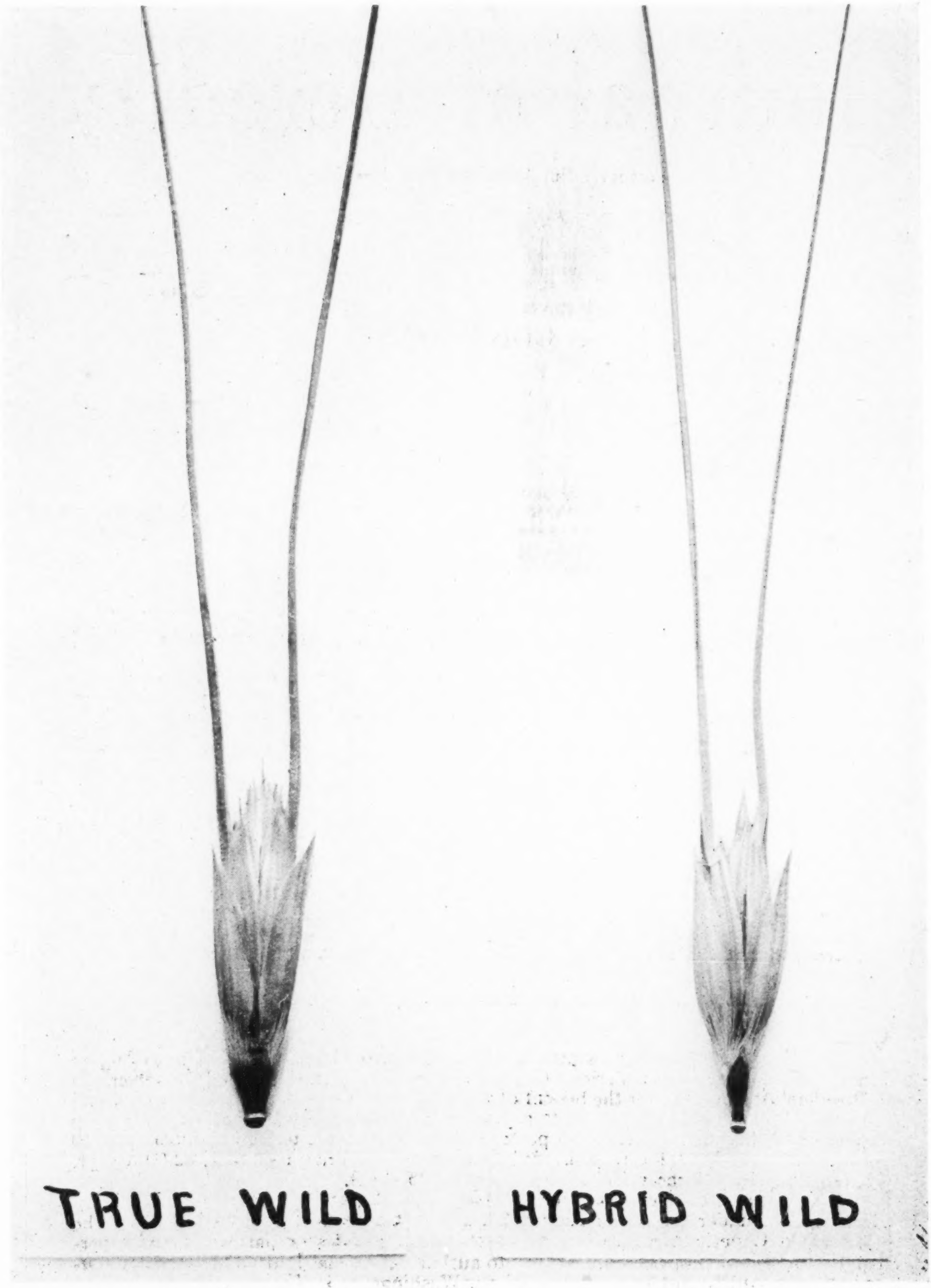
Date of issue of this number, April 5, 1919.



WILD WHEAT FROM PALESTINE AND NEW HYBRID

Here is shown a spikelet of the true wild wheat and one of the hybrid forms. (Frontispiece.)

THE SYNTHETIC PRODUCTION OF WILD WHEAT FORMS[1]

H. H. Love and W. T. Craig[2]

The rediscovery of wild wheat or wild emmer in Palestine by Aaron Aaronsohn[3] is of great interest to those investigators who are concerning themselves with work in cereals, particularly with wheat. It also is of general interest, since any evidence that may be produced to connect domestic varieties with their wild prototypes is always of interest.

Körnicke found in the National Museum of Vienna some Hordeum spontaneum which Kotschy had gathered at Rasheyya, Palestine, on the northwestern side of Mount Hermon about 1855. Among the stems of this material was part of an ear which Körnicke considered to be wild wheat and later named it *Triticum vulgare dicoccoides* and declared it to be the prototype of the cultivated wheats.

No further information was obtained, and no more material of this wild type was found until Aaronsohn in 1906 found a plant at Rosh Pinar in Palestine. Later in the same year near Rasheyya, Palestine, he found many plants of wild wheat in the uncultivated fields. He found a great diversity of forms such as black-glumed types, pubescent forms and other variations. No forms were found which Aaronsohn believed were hybrids between the wild type and the cultivated forms. This wild type came to be named *Triticum dicoccum dicoccoides*, but Cook[4] has suggested the name *Triticum hermonis*, due to its being found on and near Mount Hermon.

The wild wheat was usually associated with wild barley and was found in other places in Palestine by Aaronsohn on other botanical explorations. Aaronsohn stated that this wild form is either the prototype of cultivated wheats or one of the oldest forms derived from such a prototype.

During 1910, Cook, in connection with an investigation of cotton culture in Egypt, visited the wild wheat country in Palestine. The results of this inspection have been fully described.[4] Cook gives a very complete description of this wild form and a number of its variations as found in Palestine, as well as its adaptation to cross fertilization.

In regard to this being the wild prototype Cook says: "Though there is no reason for any further doubt of the existence of a wild type of wheat in Palestine, equal certainty cannot be claimed for the idea that the Palestine wild wheat is the ancester or true prototype of the domesticated types of wheat. It is still doubtful whether all the cultivated types of wheat arose from a single wild species or from different species. Though the wild wheat of Palestine possesses all the characters that the European specialists expected to find in the primitive ancestor or prototype of the domestic wheat, these characters might also be expected to occur in any wild relative of the wheat plant and do not afford ground for a final conclusion regarding the relationships that exist between the wild wheat of Palestine and the domesticated cereals."

---

[1]Paper No. 75 of the Department of Plant Breeding, Cornell University, Ithaca, N. Y.

[2]In cooperation with the Office of Cereal Investigations, U. S. Department of Agriculture.

[3]Aaronsohn, Aaron: "Agricultural and Botanical Explorations in Palestine. U. S. Department of Agriculture, Bureau of Plant Industry Bull. 180 (1910).

[4]Cook, O. F.: "Wild Wheat in Palestine." U. S. Department of Agriculture, Bureau of Plant Industry Bull. 274 (1913).

EARLY RED CHIEF AND MAROUANI CROSS

Heads of the parent forms and the F_1 hybrid. The parents are designated by *x* and *y* and the hybrid by *a*. (Fig. 1.)

SECOND GENERATION

The second generation was grown in the greenhouse. 113 plants resulted. Among these plants various forms were produced, as is usual among crosses between common and durum wheat. Note 112, which is the form which produced wild types. (Fig. 2.)

This wild type has a brittle rachis as has wild barley. The rachis is not merely brittle in the sense that it breaks easily as does that of emmer or spelt, but it has a special articulation that permits the joints to separate at maturity. These joints are firmly attached to the spikelets so that they serve as a beak for the latter. Along the sides of the joints are stiff bristles or hairs which increase toward the upper end of the joint.

The glumes of the wild wheat are very stiff, thus holding the grains very tight so that they are threshed with difficulty. These are some of the main differences between the head of the wild wheat and that of common wheat. The plant of the wild wheat is different from that of the common wheat, the stems being finer and the leaves narrower. The foliage is of a lighter green color than ordinary wheat. An illustration of the wild type of spikelet is shown in the frontispiece.

MATERIAL

While engaged in studying inheritance in wheat from various crosses our attention was attracted particularly to one, a species of cross between varieties of the common and durum types. From this cross, forms resembling the wild type were obtained among the segregates in F_2.

This cross is one made between *T. vulgare* var. Early Red Chief and *T. durum* var. Marouani. The Early Red Chief variety was a typical *T. vulgare* form, was beardless, had smooth brown chaff and a red kernel. The Marouani was a typical durum form, was bearded, had a smooth white or yellowish-white chaff and yellow or yellowish-white kernel, which for this study can be considered colorless. C. R. Ball, who has examined this type, says that it is more like an intermediate between Pelessier and Marouani. The sort used had black awns which, according to Ball, the true Marouani does not have. At the base of the spikelet of the Marouani are a few hairs or bristles.

The F_1 type produced from this cross was intermediate in regard to certain characters. There were a few very short beards at the tip of the head which had some black coloration, but were not nearly so black as those of the Marouani parent. The glumes were longer and stiffer than in the female parent, but not so long as in the male. They were pointed at the tip more like the Marouani variety. The kernel was somewhat longer than that of the female parent and was red in color. On the joints of the rachis are a few very short bristles or hairs.

The parent types and F_1 are shown in Fig. 1. The F_1 type is the form shown between the two parent forms.

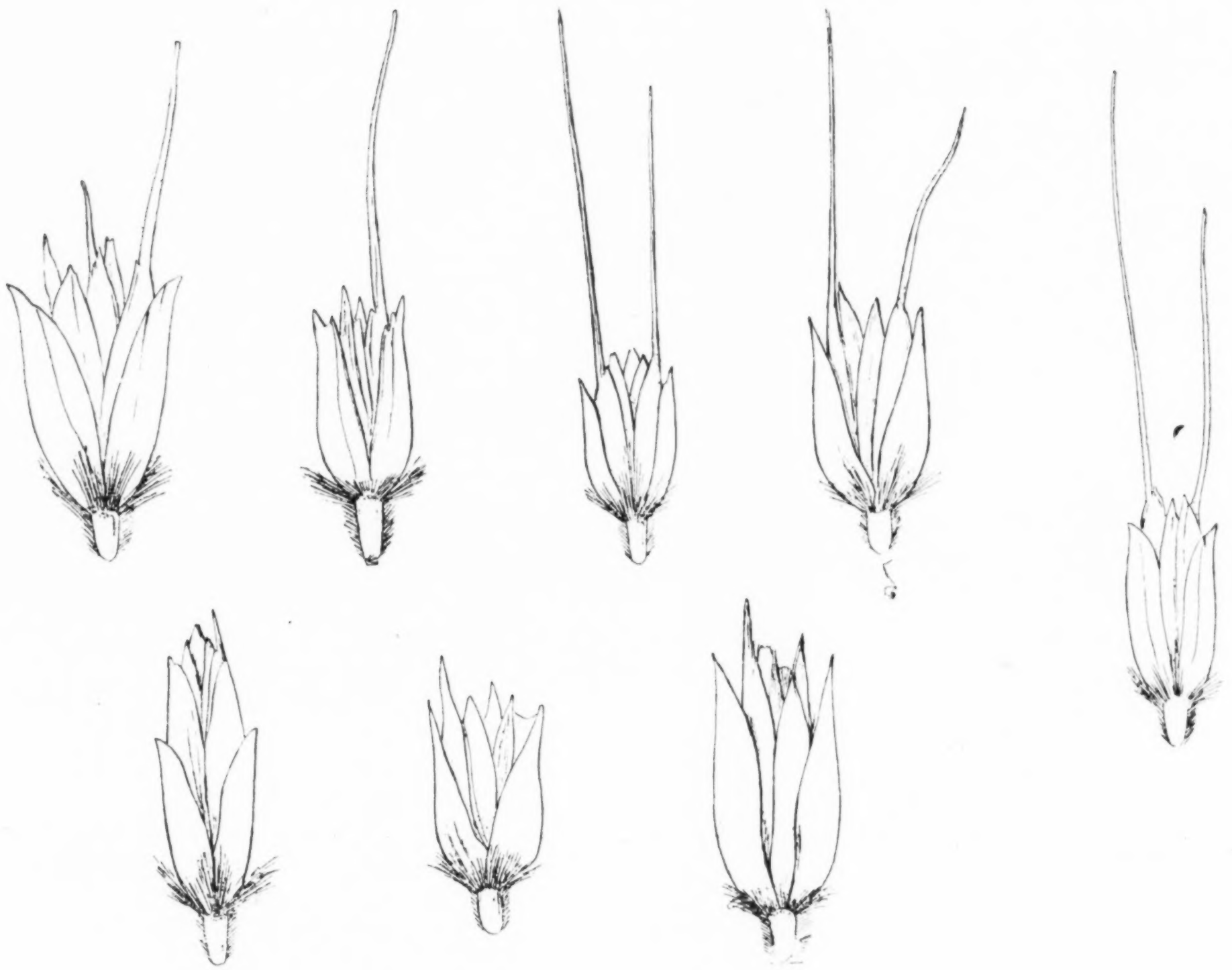
The second generation was grown in the greenhouse and 113 plants resulted. Among these plants various forms were produced, as is usual among crosses between common and durum wheats. Some of these forms are shown in Fig. 2. While it is not planned in this paper to discuss fully the results as to different forms and characters, a short statement regarding some of the results may be of interest.

In regard to the color of chaff there were in this generation 107 brown chaff to 6 white chaff plants, thus indicating a 15:1 ratio. The color of kernel was noted on all plants that produced kernels and these gave 77 red:5 white kernels. This would indicate a 15:1 ratio for the color of kernel also. In regard to awns there were 83 awnless:30 fully awned plants, which indicates that the awned condition is recessive and inherited on a 3:1 basis. It is well to state, however, that among the 83 plants designated as awnless there are some with a few very long awns on some of the spikelets. The fully awned plants are those that possess awns like the ordinary varieties of awned wheat, while some of the awnless plants with long awns have them only at the tip. One plant in particular had awns developed at the tip of the spike only, yet they measured 10.8 cm. in length, while the longest awns found on any of the plants were only 13.7 cm.

RESULTS FROM PLANTING SEED OF No. 112.

THIRD GENERATION

No. 112 shown in Fig. 2 resembled the wild type. Seeds were sown from this to grow an F_3. Some of the results are here shown. (Fig. 3.)



SPIKELETS IN THE THIRD GENERATION

Spikelets from different F_3 plants produced from 112 and 113. Drawings made by C. W. Redwood. (Fig. 4.)

in length. It is of interest to state in this connection that certain families in later generations bred true to the condition where awns were developed at the tip of the head only. These awns developed a length, however, equal to that of fully awned plants. Of the 30 awned plants only 6 developed black color like the Marouani variety. More data are being obtained, however, on this character.

The shape of the glume, that is, whether pointed at the tip or having a shoulder, segregated into 82 pointed glumes : 28 non-pointed.

Many of these F_2 plants were tested in F_3. Owing to a poor stand, however, not enough plants were obtained in all families to determine the inheritance of the various characters. In general, however, the results of the third generation agree with the conclusions drawn from the material of the second generation.

Among the F_2 plants were two (Nos. 112 and 113) which are of particular interest in relation to the wild prototype question, and it is a description of these and their progeny which we will now consider. These two plants were in many respects similar to the wild wheat. They both possessed the brittle rachis and long basal hairs or bristles. One form was beardless, while the other was partially bearded. The kernels were longer than in the other segregates and resembled the wild type. The heads were flat, similar to the true wild form. One of these forms, No. 112, is shown in Fig. 2. The one main difference between the true wild wheat and these segregates was that the spikelets of the segregates were somewhat broader than those of the wild type.

HYBRIDS SIMILAR TO THE WILD FORM

One pedigree produced hybrids very similar to the true wild type. Spikelets of true wild and hybrid type are here shown. (Fig. 5.)

KERNELS OF PARENT AND TRUE WILD TYPES

Upper kernels, female, of parent type. Lower kernels are the true wild types. The kernels of the synthetic wild type, shown on the opposite page, may be somewhat more plump than those of the true wild, yet many of these are actually identical in all respects. (Fig. 6.)

KERNELS OF PARENT AND SYNTHETIC WILD

Upper kernels, male of parent type. Lower kernels are of the synthetic wild, which so strongly resembles the true wild. (Fig. 7.)

Each spikelet, however, carried away the joint of the rachis attached to it just as does the true wild wheat.

At first thought it may be suggested that these two forms arose because of a natural cross with the F_1 plant and the wild wheat. Such is not a possibility, however, since no wild wheat had been grown in any of our cultures until the year the F_2 was grown, and then these plants were in a distant part of the greenhouse.

Seed from both plants Nos. 112 and 113 were sown to grow an F_3 and produced some very interesting forms. Some of these forms obtained from No. 112 are shown in Fig. 3. Plant 112 produced enough seed so that 70 plants were grown in F_3. They segregated for various characters such as color of chaff, awns, and the like.

In regard to color of chaff a segregation of 52 brown: 18 white chaff was obtained. Awnless, intermediate, and awned plants were obtained as follows: 18: 38: 14. A great many of the spikes were flat, much like the spike of the wild type. There was a tendency on the part of many plants to produce compact-like heads. Most of these were flattened, but not of the true wild type of head. All of the plants possessed the long basal bristles similar in length and amount to those borne by the wild sort. All kernels were red, and very many of them similar in shape and length to the wild type of kernel. Finally, in regard to the fragile rachis, most of the plants produced heads with a fragile rachis. There was considerable variation with respect to this character. Some of the spikelets separated at maturity, thus making it difficult to harvest them, while others would not separate until they were being handled. Some were in all respects as fragile as the wild form. Only 5 or 6 plants had a somewhat solid rachis. Certain of the spikelets obtained in this F_3 are shown in Fig. 4. While there is some variation in regard to size, shape, and the like, all are similar in that they carry with them the joint of the rachis, which has a duck-bill appearance.

Only 10 plants were obtained in F_3 from plant 113. In general, their behavior was similar to that of the segregates from plant 112. Some of the plants from F_3 were tested again in F_4. The results as obtained, so far as the character of brittle rachis is concerned, showed that practically all of the plants produced heads with the brittle rachis. There was some variation, yet most of them were brittle. Only 3 plants produced heads that broke apart with difficulty. All of the plants produced red kernels and the long basal bristles. Most of the plants produced their spikes on straw which was solid for some distance below the first joint of the spike. A number of the kernel shapes were very similar; in fact some were identical with the wild. The plants produced from pedigree 2030a1-112-7 were very similar in all respects to wild, as will be seen from inspection of Fig. 5, since one of these segregates is shown with the true wild type. It may seem that the awns of the wild type are heavier than the wild segregate. However, other forms have been obtained with awns as heavy as the wild. In addition to the characters of the spike being similar to those of the wild wheat, the habit and appearance of the plants also were similar to the wild type. The plants had fine stems and leaves and the color was of a lighter green than is common among the domestic wheats.

Seed from certain of these F_4 plants were sown and another generation was grown. The results of this planting were very similar to those of F_4, thus indicating that the plants all bred true to the character of the fragile rachis. Some of the families produced were like the wild in all of their characters. This is particularly true with respect to two families. In family 112-4-4 the rachis was very fragile and, although there was segregation regarding awns the awned types were very much like the wild wheat.

The offspring of 2030a1-112-7 were all classed as wild types in the fifth generation, so there is no question of doubt but that types in every way similar to

REVERSED AWNS

The awns of wheat when present are ordinarily grown on the flowering glume, not on the the empty glumes. The empty glumes may bear a short beak. (Fig. 8.)

the wild wheat have been produced synthetically. The spikelets of these individuals are represented together with the true wild in Fig. 5. The kernel types of the parent varieties and those of the true wild and synthetic wild are shown in Figs. 6 and 7. The kernels of the synthetic type may be somewhat more plump than those of the true wild, yet many of these are actually identical in all respects.

REVERSED AWNS

Another very interesting fact observed in this cross was that of the reversed awn condition. The awns of wheat, when present, are borne by the flowering glumes. The empty glumes may bear a short beak and in some sorts this beak may develop a length of at least 1 cm.

Among the segregates of 112 were found some types on which the awn was produced on the empty glume and the beak on the flowering glume (Figs. 8 and 9). All of the awns were not thus reversed, but usually one on a spikelet. Sometimes the awn and beak were nearly of the same length, when again the beak on the flowering glume would be no longer than the beak usually borne on the empty glumes. While studying thousands of wheat segregates, this character has never been observed in any other cross.

Seed from certain of these reversed awn types have been sown, and it is found that the abnormality is reproduced in the following generation. In fact, one family at least gives every indication that it is homozygous for the reversed awn, as all of the plants in the family of the fifth generation have this condition.

Crosses between types with the reversed awn and the ordinary types have not been made as yet to determine the behavior of this character in crossing, but it is planned to make such crosses.

BEHAVIOR OF WILD WHEAT IN CROSSES

While studying the wild segregates it was considered necessary to determine how the characters of the true wild wheat were inherited when crossed with other types. Two such crosses have so far been observed. One durum variety, Gharnovka, and one common variety, Extra Early Windsor, were each crossed with the wild wheat. It is not planned to give these results here in detail. A few facts, however, will show the inheritance of certain characters.

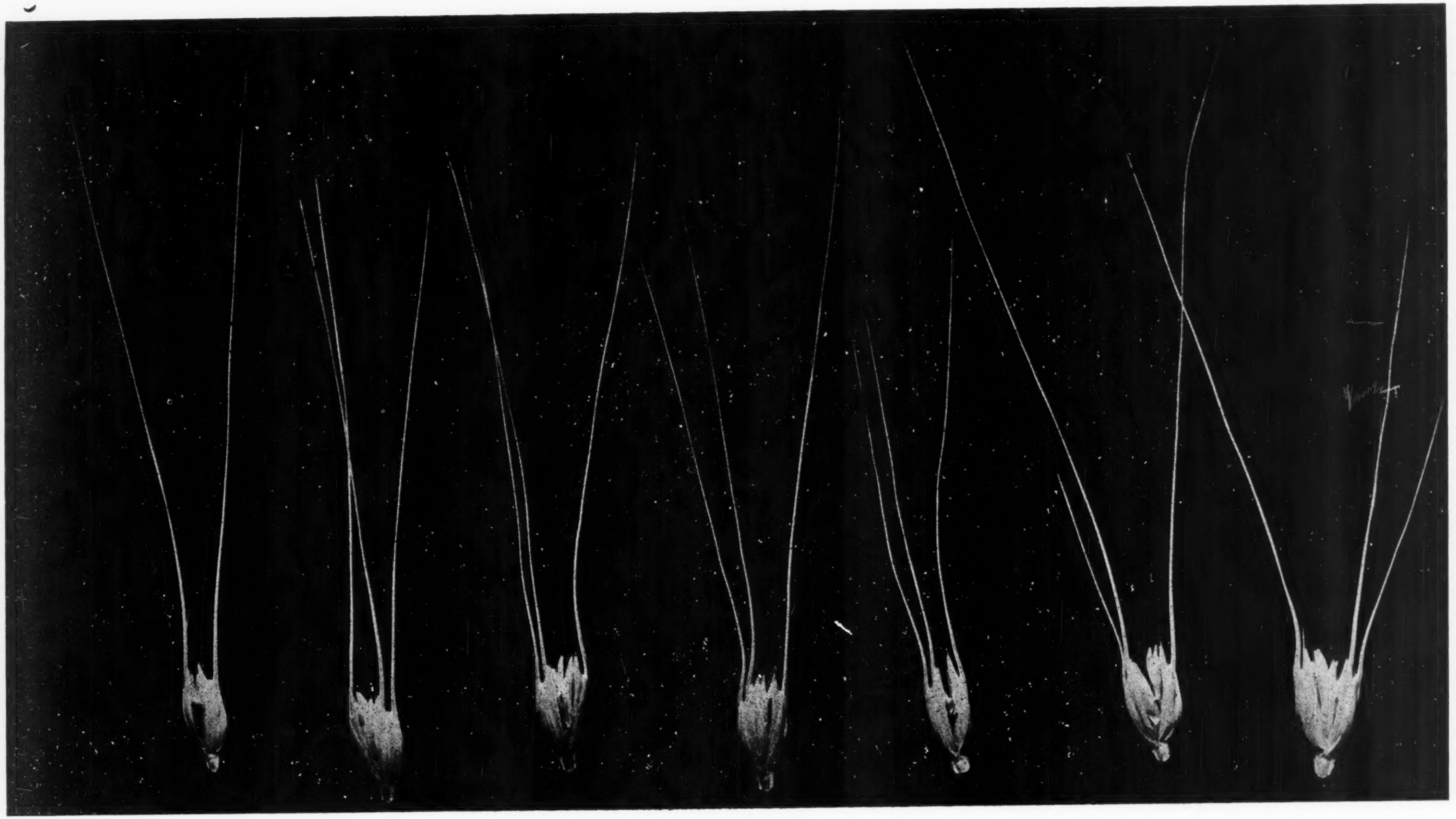
In the F_1 the brittle rachis is dominant, or partially so, over the solid or ordinary type of rachis. On the joints of the rachis are many basal hairs or bristles. The spikelets look much like those of the wild type, except that they are broader.

When the F_2 is inspected it is clear that the fragile rachis segregates, at least in these crosses, on what seems to be a 3:1 ratio. Types are obtained which resemble the wild type used as a parent. These have the flattened heads, long, stiff glumes, basal bristles and long kernels like the wild type. The red kernel color of the wild type seems to be the resultant of two factors according to the ratios obtained.

It is clear from these crosses that the wild type is obtained as a segregate in the F_2 and succeeding generations, thus adding further evidence that, had it been possible for the wild types obtained from the Early Red Chief-Marouani cross to have been the result of a natural cross, further segregations would have been obtained in the following generation. It is clear also that the characters of the wild wheat behave in hybridization much as do the characters of the other wheat types.

GENERAL DISCUSSION

The occurrence of this wild form is a cross between the common and durum types is of considerable interest, since it may throw some light on the question as to the prototype of our common wheats. Since in the second generation there were two wild-like plants found out of a total of 113, it might be assumed that they occur as a natural result of ordinary segregation, and, occurring in this proportion, might indicate a 63:1 ratio. If this were true,



REVERSED AWNS

Among the descendants of 112 shown in Fig. 2 some of the segregated types are here shown with reversed awns. Generally all of the awns were not reversed, but usually one on a spikelet. (Fig. 9.)

one would expect that in F_3 certain families would be found which would produce more of the wild types. Only one such family was obtained, however. Owing to the fact that there was a poor stand in F_2 due to a heavy rain just after sowing, it cannot be said definitely that more families did not exist which may have produced wild forms if a full stand had been obtained. It seems, however, that enough plants were obtained so that, if as many families produced, or would have produced, wild plants as expected in F_3, a number of wild plants would have been obtained in this generation. More evidence on this point cannot be obtained until this cross is repeated, which is now being done.

The occurrence of these forms may lead to the conclusion that the wild wheat of Palestine is the prototype of our domestic wheats and that the factor or factors necessary to its production were carried by either of the parent forms and that through some fortunate combination of factors the wild types were produced. If this were true, then is it not possible that many varieties may carry these factors and that through crossing these the wild wheat forms would be produced? Such does not occur, however, for in several hundred different wheat crosses under our observation no such wild types have been produced except those in the one cross discussed. These combinations include crosses between the emmers, spelts, durums, clubs, and common wheat.

It is possible that these forms may have occurred through mutative changes so far as the factors for the production of type of rachis, basal hairs, shape of kernel and the like. It has been noted that there were segregations in F_4 and F_5 regarding awns, so that if a mutation did occur it was not one affecting all the characters but only those mentioned. If it is later evident that these types have arisen through mutation, it will be interesting, since it will be the origin of a type with dominant characters. Such cases are rather rare.

Since these wild-like forms have occurred through crossing it does *not* follow that the wild wheat of Palestine is certainly a prototype of the common wheat. For, as suggested above, we might expect such occurrences more commonly. For example, in Avena crosses the wild *A. fatua* is not produced commonly, if ever, when crosses between different types of oats are made,[6] even though the varieties of *A. sativa* are thought to have been deived from *A. fatua*.

From the evidence one might well put forth the suggestion that the wild wheat of Palestine may have been produced originally through a natural cross. Owing to its very excellent adaptations for self-dissemination it would naturally spread and fill up waste places. The wild oat of the west is more common in waste places than in cultivated fields. It occurs in cultivated fields but, owing to cultivation, is not so common. Wild wheat, then, may even exist occasionally, though unnoticed, in cultivated fields.

The occurrence of wild segregates in the cross described does not prove that the wild wheat is the prototype of wheat, but rather raises the question whether it really is a protoype or a contemporary form. More data from other crosses will be needed before any definite statement can be made. May it not be possible that there is a certain type (or types) in Palestine that, when crossed with others, may frequently produce the wild type?

CONCLUSION

A wild type of wheat was produced by crossing a durum with a common wheat.

This type of segregates from this type was similar in all respects to the typical wild wheat of Palestine.

The occurrence of this wild form may be evidence in favor of the prototype theory in relation to the wild wheat of Palestine or indicate that such a wild form may have arisen through natural crossing between already existing forms.

[6] The authors have some evidence that such may be produced in certain crosses.

PRESENT CONDITION AND OPPORTUNITY OF THE AMERICAN GENETIC ASSOCIATION[1]

DAVID FAIRCHILD

THE YEAR which has passed since our last meeting is one of the most remarkable in the history of mankind. Through the whirl of terrific forces which has characterized it I feel sure all of us must see a drift that threatens many or all of the familiar adjustments of human society. Whether we understand that drift or not, we must recognize that it is fraught with the most sinister possibilities. The rupture of the fabric of society, which we have seen going on around us and read of as an overwhelming catastrophe in Russia and as threatening all Europe, we must begin to consider as a phenomenon based upon the rapid spread of propaganda which is as unsound biologically from the standpoint of this new science of genetics as the theory of the flat earth was unsound physically. In becoming more scientific, in the sense of being more open-minded and accessible to new ideas, the world has become more susceptible to destructive as well as to constructive suggestions, and since it is vastly easier to detroy what now exists than to develop and apply constructive solutions of our problems, the dangers of the present situation are hardly to be exaggerated.

All of these burning questions of the day, which are stirring men's hearts and angering or saddening them, must have answers based upon principles. What are these principles? It is likely that they will ever be revealed through the discussion and deductive reasoning of men like the bolshevik leaders of Russia? Have we not witnessed long enough the steady growth of the exact sciences to feel convinced that there is no other method by which the human mind can arrive at stable notions of things than through the methods of experiment and objective observation? There is no short cut—no inspiration based upon ignorance of what has gone before.

The spectacle of the influence of a single abnormal personality upon a nation of sixty millions and of our own concentration of authority in the hands of the President as the only means of meeting a real crisis should make us realize, as never before, the paramount importance of the individual, as a focus or nucleus bearing the fate of an entire nation or race. The weak personality of the Tzar, and the absolute chaos for lack of strong leaders after his destruction, form a picture which is terrible to contemplate.

The spread of personal propaganda, and by this I mean the systematic propaganda which attracts and rivets the minds of millions upon the personality of some public official, has developed since the war began to proportions undreamed of before, and this phenomenon is one which deserves the closest scrutiny. The formation of convenient brain patterns in the form of slogans and their use by those who declare in a loud voice that they see confidently into the future, but whose theories are false for all their assumption of superior knowledge, will force upon the scientific community, who are the real intellectuals of the world, the necessity of some adequate counter-propaganda in which the factors of human welfare, as shown by the science of inheritance, will be driven home and sink deep into the consciousnesses of great mass of the people.

If the false doctrines that threaten

[1] President's address delivered before the Annual Meeting of the American Genetic Association, Washington, D. C., January 9, 1919.

to destroy society as a living organism and replace it with an arbitrary and artificial system directed from below by the less intelligent elements of the population should prevail, an era of extreme depression and chaos might easily come upon us, a period of disintegration and decay like that of the Roman Empire and the dark ages that followed the complete overturning of society. Think of the Spanish Inquisition from the standpoint of propaganda. Recall how it swept over and blasted a capable and rapidly developing nation and ran into other countries like an epidemic. Can we be confident that those who think they can control public opinion know what they are doing—especially when we see erroneous ideas and misstatements of fact in this torrent of propaganda? As scientific men we know more facts and see the drift of many things, but our honesty, and especially our repugnance towards self advertising, prevents us from taking the place which we ought to take in the councils of the people. We cannot reach them with our scientific jargon, and our desire to be true to the cult of our science and to stand well with our professional colleagues keeps us from popularizing our ideas and thus exerting at least a fraction of the influence which is our right and our responsibility as students of these tremendous problems.

We are here as members of the American Genetic Association, an association of scientific men and of those who are interested in the great subject of heredity and its relation to human welfare. And we are citizens of a country which stands before the world as no country before has stood. The times are fraught with the greatest dangers, and these dangers lie in the realm of the understanding and are based upon certain laws of inheritance, which we are investigating. One of the greatest tools which can be used to educate the public is the tool of illustration. The most prominent feature in the propaganda program is the use of striking pictures, pictures which really tell a story; pictures which have been prepared for the express purpose of producing a certain effect. You all know, as well as I do, that we have the materials, and what we should do is to use them for the enlightenment of a widening audience of the most intelligent people of the country.

The situation, as I see it, constitutes one of the greatest opportuniies of our lives, and I cannot overemphasize my feelings in the matter, for they amount to conviction. If we handle the situation at this time, we will do a great service to the world. If we do not, we fail, and a great opportunity passes. While we delay or hesitate, other organizations, with more obvious but less important appeals to the intelligence of the people, are forging ahead with evanescent, distorted and moral-destroying propaganda.

Our propaganda should be against the almost universal fallacy which pervades society ideas everywhere that acquired characters are somehow and in some mysterious way inherited. The non-inheritance of acquired characters is a well-established theory, but the general public does not know it. Through the educational propaganda, through the charitable propaganda, through the sporting propaganda and through the medical propaganda there runs everywhere the unspoken assumption that, given a good environment, any child is as likely to be great as any other; and everywhere we find people who are searching for all of the causes of crime and degeneracy in the environment. The wayward son of the preacher, the deaf from childhood, the small-sized boys of small parents who "never got enough to eat when they were young," the effect of hats as causes of baldness, the causes of longevity, and a host of others are now "explained" by those who do not know. Millions of dollars are expended every year upon palliative remedies with the firm conviction of the givers that they are curative measures, whereas they end with the generation they assist.

If through the propaganda of this little Journal of the Association we could get a hundred thousand people to

thinking regarding the real difference between the phenomena of environment as distinguished from those of heredity, the accomplishment would be a great positive gain to our country.

These differences can only be learned through study. They cannot be taught like so many of the superficial facts of the advertising business by the diagrams or pictures of a single poster.

The background of plants and animals and their behavior must be presented and the mind led up to the great fact of heredity by a series of steps which requires many pictures and illustrations to make clear.

It is hard for the layman to believe that you can cut off the tail of a white mouse and its daughter and her daughter and all the daughters for a hundred generations and of the sons as well without producing a tailless breed of white mice, whereas, if you hunt the world over, you will probably find somewhere a pair of mice which were born without tails and, by breeding these together and selecting the tailless ones and mating these again, produce in a few generations a breed of tailless white mice. A variety of spineless cactus cannot be produced by rubbing off the spines and making cuttings from the spineless portion. Identical twins often remain through life so much alike that they are mistaken for each other, whether they have lived in the same environment, or have led the same kind of life or not.

It is the propaganda for an understanding, a universal study of the great forces which we know are here, that our journal should undertake, and the first great work lies in the elucidation of the fundamental difference which exists between the changes wrought by our environment and the limitations which come through our heredity. What experience can be more bitter than that of offering all the possibilities of the widest imaginable environment to a youth only to find that he does not want them, that he simply cannot rise to their utilizaion. "He could if he would only try," sums up too often a case of defective inheritance. But these I know are too complicated matters to be carelessly answered in this way. They present the most difficult problems in this new science. They are in the very field which the JOURNAL must enter with its propaganda, viz., the field of the inheritance of *mental* and *moral* characteristics, in which field the evidence is rapidly accumulating, making it more and more certain that they *are* inherited and are scarcely more easily changed than a child who is slow at figures can be made into a great mathematician or one who cannot carry a tune can be developed into a great composer.

Preparing for Great Food-Raising Tasks of "After the War"

"Strengthen agriculture's organizations for 1919."

This slogan has gone from Washington to every State—in preparation for the huge after-war tasks of American farmers—and reports of responses in every section of the country now are coming to the United States Department of Agriculture.

Tens of thousands of farmers are joining and making stronger the county councils of agriculture, county farm bureaus, and other local extension organizations that have come to hold a place of vital importance in the organized agriculture of America.

These local organizations of farmers occupy much the same relation to the counties as chambers of commerce occupy to cities. They plan for prosperous and balanced agriculture, introduce better farming methods, work for more and wider markets. They deal especially with the work of the cooperative agricultural extension agencies, and are not intended to take the place of the existing farmers' organizations, with which they sustain many helpful and cordial relationships.—*Weekly News Letter, U. S. Dept. of Agriculture.*

SOME PRESENT ASPECTS OF IMMIGRATION

Fourth Report of the Committee on Immigration of the American Genetic Association.[1]

THE last Report of the Committee on Immigration was made about one year before this country entered the war.[2] In that report this committee stated its reasons for believing (1) that the war would be followed by a very large increase in the numbers of immigrants, and (2) that the general effect of the war as a whole would probably be to cause a deterioration in the mental, physical and moral characteristic of our future immigants and of their descendants. A summary of the immigration bill then pending in Congress was given, and the committee expressed itself as heartily in favor of all the provisions looking towards the more effective detection, exclusion and deportation of mentally and physically unfit aliens. This bill, after having passed both houses of Congress, was vetoed twice by President Wilson, but was passed over the veto by both Senate and House and became law on February 5, 1917, about one month before this country declared war. The new statute became effective on May 1, 1917. It is by far the most comprehensive immigration legislation ever enacted in this country and, *if properly enforced,* can become of immense benefit to our future race.

The effect of the war in diminishing the volume of immigration to the United States was, of course, expected, but has nevertheless been striking. From an annual immigration of nearly a million and a half during the fiscal years 1913 and 1914, and an annual net increase in alien population (*i. e.,* deducting the numbers of those who returned to their own countries) of 800,000, the number of immigrant aliens fell to a little over 325,000 during the year ending June 30, 1915. In the fiscal years 1916 and 1917, about 300,000 came, while in the year ending June 30 last the number of immigrant aliens was only 110,000. From July to October, 1918, the number of immigrant aliens was 37,410, and of non-immigrant aliens 25,729. While the mere fact of greater or smaller numbers does not, in and for itself, concern this committee, there is a very important aspect of a small immigration which is of the greatest interest to eugenists. It has always been held by those who are concerned regarding the admission into the United States of mentally and physically defective aliens that, with a smaller number of alien arrivals, the work of inspection could be more effectively done, with the inevitable and greatly-to-be-desired result that fewer undesirables would escape detection. Our experience during the war has borne out this view. The last Report of the Commissioner General of Immigration (for the year ending June 30, 1918) gives the following percentages of aliens who were refused admission for all causes: 1914, 2.3%; 1915, 5.3%; 1916, 4.9%; 1917, 4.2%; 1918, 3.3%. The increase in the

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[1] Personnel of Committee: Alexander E. Cance, Amherst, Mass.; Irving Fisher, New Haven, Conn.; Prescott F. Hall, Boston, Mass., Chairman; Dr. Thomas F. Salmon, New York City; Robert De C. Ward, Cambridge, Mass., Secretary.

This report has not been submitted to Professor Cance and to Dr. (now Colonel) Salmon, both of whom are overseas.

[2] See *Journal of Heredity*, vol. vii, No. 6, June, 1916, pp. 243–248.

percentage of rejections during the war is to be ascribed, according to the Commissioner General, to two causes: first, a deterioration in the quality of immigration itself; and second, to the more rigid inspection made possible by the decreased numbers. One of the provisions of the new Immigration Act requires that *two* inspection officers shall, whenever practicable, pass upon the case of each alien, and the same is true of the medical inspection. It is interesting to note that 23% of the total number of all rejections for the year 1918 were due to the operation of new provisions in the Act of February 5, 1917. Among those rejected because of such new provisions there were 20 certified for chronic psychopathic inferiority; 24 chronic alcoholics; 17 afflicted with "tuberculosis in any form" as distinguished from tuberculosis of the respiratory, intestinal or urinary tracts, these being excludable under the old law; 10 aliens mentally defective without regard to the effect of such defect upon the ability to earn a living. In addition to the foregoing, debarred under new provisions, there were debarred under provisions contained in both the old and new laws, 4 idiots, 5 imbeciles, 64 insane, 31 epileptics, and 19 feeble-minded. That even the new law does not accomplish all that is desirable is shown by the fact that, in 1918, out of 6,153 aliens certified by the surgeons as mentally or physically defective, 4,558, or 74.1%, were landed. In 1917, 71.4% were landed.

An excellent provision of the new Immigration Act is the extension of the period during which the expulsion of defective aliens can be accomplished. In the past year 106 aliens suffering from serious mental defects were expelled from the country. Of this number, 17 were so afflicted when they were originally admitted, 78 became insane within five years after landing, and 11 became public charges because of other mental defects. In the previous year, 172 aliens suffering from serious mental defects were expelled. Of these, 38 had been so afflicted at the time of entry and 130 had become public charges within three years after entry because of insanity.

In the last Report of this Committee, attention was called to the great importance of the proposed increase in the fines to be levied on the transportation companies in cases where aliens, clearly excludable under the law, are brought to this country. These increased fines are now embodied in the new Immigration Act. It is obviously a very great hardship on individual aliens who have made the long journey to this country to turn them back at our ports when they are found to belong in the excluded classes. Such cases are often reported in our newspapers, naturally arouse widespread sentimental interest, and usually bring out unreasonable and ill-judged protests against any rigid enforcement of the Immigration Act. Experience has shown that the only way to diminish the number of such cases of hardship is to levy considerable fines upon the steamship companies when they give passage to aliens who, on embarkation, clearly fall into the excluded classes which are named in the law. The new Immigration Act increases the fines in cases where they were already provided and established new fines in other cases. During the past fiscal year, a total of $63,515 was collected in such fines. Of this amount, $7,325 was levied because of the bringing to our ports of mentally or physically diseased aliens. A rigid medical inspection of all arriving aliens, and the collection of fines in all cases where such fines can clearly be imposed would certainly do a very great deal, under the excellent provisions of the present law, to improve the mental and physical qualities of our immigrants. That much more could be done under the administrative fine provisions is shown by the fact that, while 954 aliens were debarred as being physically or mentally diseased or defective, fines were imposed for bringing only 93 of these.

If any further arguments were needed to show the value and importance of

our new Immigration Act, the war has supplied them. This law is our only breakwater against the advancing tide of immigration which, unless all signs fail, is likely to be both increased in quantity and lowered in quality. The new law has not yet stood the test of a large immigration. Everything should be done to secure its effective administration. Its rigid enforcement would unquestionably result in an improvement in the mental and physical qualities of our immigrants even if it was not designed to, and cannot, greatly reduce their numbers.

The almost certain prospect of a greatly increased immigration closely following the ending of the war, the manifest injustice of exposing our returning soldiers and sailors to competition with the low-priced labor of Europe and of Western Asia, and the conviction that our present immigration law is qualitatively selective rather than numerically restrictive have naturally resulted in a widespread demand for immediate further legislation. The Immigration Committee of the House of Representatives has reported a bill (H. R. 15302, Union Calendar No. 359; Report No. 1015) suspending immigration for four years with many exceptions in the cases of certain professional classes; the near relations of aliens now in or citizens of the United States; aliens from Canada, Newfoundland, Cuba and Mexico; aliens who are refugees because of various kinds of persecution, and of aliens admitted temporarily under regulations to be prescribed by the Commissioner General of Immigration with the approval of the Secretary of Labor.

The general economic aspect of the immigration problem does not concern the Committee on Immigration of the American Genetic Association. This committee therefore does not feel called upon to express any opinion as to the merits, or otherwise, of the pending bill. It is, however, convinced that a reduction in the numbers of our immigrants does simplify and render more effective the task of inspection, and therefore leads to the administration of fewer mentally and physically defective aliens. From that point of view, therefore, a considerable restriction, or a temporary suspension, of alien immigration would have highly desirable eugenic results.

Push the Button and Find a Pig

A Litchfield (Conn.) county agent originated an interesting plan for an agricultural survey. If you want to locate a supply of seed corn or oats, a grain binder, a pure-bred bull, or some young pigs in any community in five counties in this State, all you have to do is to walk into the office of the state librarian at Hartford, Conn., run a series of cards through an electric sorting machine, and, presto! you have the information. It may sound a little like the story of Aladdin's lamp, but it is only big business applied to farm affairs under war stress. The Council of Defense took up this plan and offered to back the farm bureaus to the limit in every county in the State. Five of the eight counties began surveys early in March, 1918. Forty questions, under the headings of area, crops harvested in 1917, crops planned to be harvested in 1918, live stock on hand, machinery on hand, and employes were included in the survey, and a corps of volunteer farmer census enumerators got busy. When the survey was completed the farm bureaus had a stack of cards containing minute information as to the resources and needs of every farm. An electric sorting machine was installed in the state library, and any fact disclosed by the survey can be made available by throwing on an electric switch. The survey has been invaluable in helping Connecticut to mobilize her agricultural forces for war needs.—*Weekly News Letter, U. S. Dept. of Agriculture.*

THE BREED IN POULTRY, AND PURE BREEDING[1]

Case in Which a Standard Bred and Supposedly Pure Bred Family Carries Factors Normal to Other Breeds and Without Being Suspected.

WILLIAM A. LIPPINCOTT

IN ATTEMPTING to give a broad answer to the question, "What is a breed of live stock?" in the JOURNAL OF HEREDITY[2] some time ago, Lloyd-Jones fell into a slight error of detail concerning poultry when he remarked, "Of Wyandottes I believe there are about a dozen varieties differing from each other in color, pattern, feathering, or comb shape." As a matter of fact, the varieties of Wyandottes do not differ in either feathering or comb shape. The comb is always rose and the feathering is uniform throughout the breed.

Poultry breeders appear to have been rather more fortunate in arriving at a definite conclusion concerning what constitutes a breed, than have the breeders of some of the larger farm animals. They have defined it as a group of domestic birds closely approaching a certain specific shape. The breed name is the one which identifies any well-defined and recognized type, such as Plymouth Rock, Wyandotte, Leghorn, Brahma, etc., and the birds conforming closely to those shapes are said to be members of those respective breeds. Some varieties within certain breeds apparently have no immediate genetic relationship.

As feathering has very much to do with a bird's shape, it is manifestly impossible for different members of a given breed to differ in feathering beyond a certain quite well-defined limit of variation. These limits are prescribed in "The Standard of Perfection," a book published by The American Poultry Association and recognized generally as the official guide by which poultry is bred and judged. The Wyandotte is, for instance, described as having featherless shanks and toes. A member of this breed carrying so much as one small feather on the shanks or toes is barred from competition in the show-room, and is said to be "disqualified."

The breeds, which are in reality the basis of poultry classification, are, for convenience, both subdivided and grouped. The subdivisions are termed varieties, while the groups are referred to as classes. There are two varietal distinctions, namely, comb shape and color of plumage; either one or both may be present. Thus the Rose Comb Rhode Island Red differs from the Single Comb Rhode Island Red only in comb shape. The White Wyandotte differs from the Buff Wyandotte only in color, while the Single Comb White Leghorn differs from the Rose Comb Brown Leghorn in both comb and color. They are members of the same breed, however, because they approach very closely the same type or shape.

For the more common breeds the class grouping is based on similar general characteristics and place of origin. The Brahma, Cochin, and Langshan, together, comprise the Asiatic class. They have all come to us from or through Asia and are birds of large size, having feathered shanks, frequently becoming broody and laying a dark-brown egg. The Leghorns, Minorcas, Anconas, Andalusians, and Spanish, which comprise

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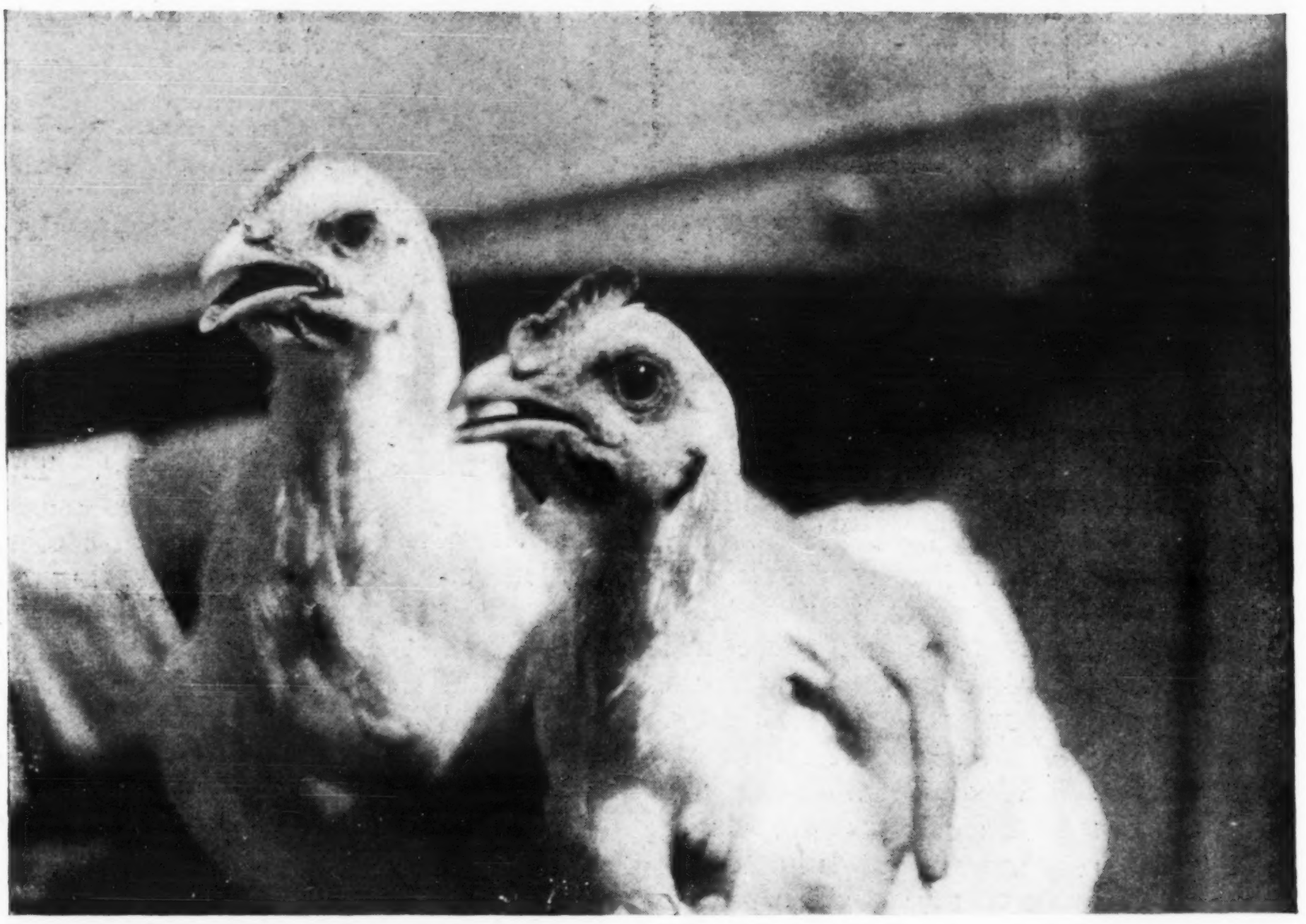
[1]Contribution from the Department of Poultry Husbandry, Kansas Agricultural Experiment Station.

[2]Vol. vi, No. 12, p. 531.



OCCASIONAL SINGLE COMB SEGREGATES

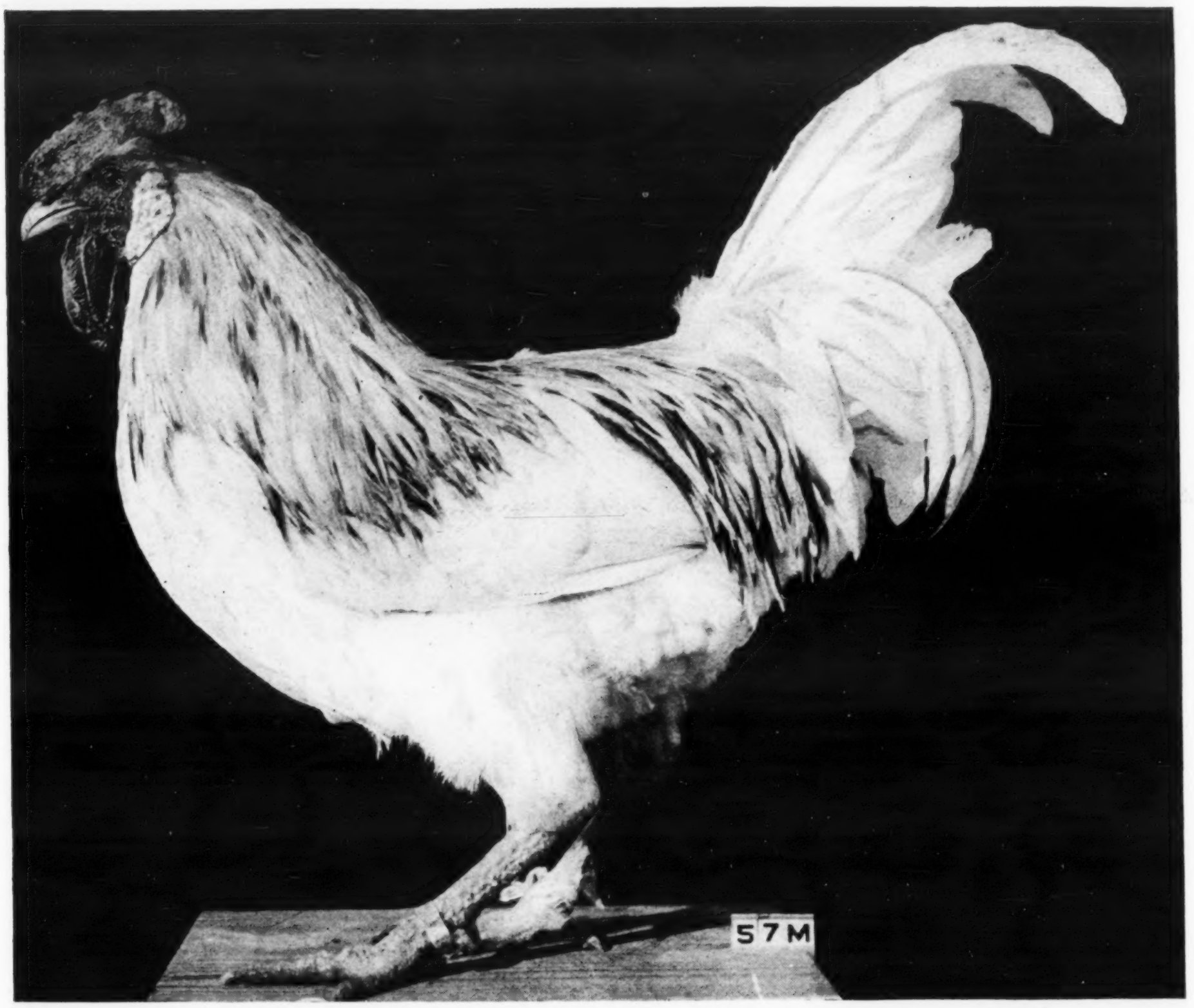
For some years occasional single comb segregates have been noticed in this standard-bred family of White Wyandottes. Any comb other than rose is a disqualification in Wyandottes. (Fig. 10.)

the Mediterranean class, all seem to have originated around the Mediterranean Sea. They are all nervous, active birds, stylish and sprightly in appearance, somewhat lacking in the brooding instinct and are layers of white eggs.

The breeds which comprise the American class are the familiar Plymouth Rock, Wyandotte, and Rhode Island Red, and the less familiar Java, Buckeye, and Dominique. These breeds were developed in America through a judicious blending of Asiatic and Mediterranean blood lines followed by rigid selection. In most characteristics they fall about half-way between the two general types from which they arose.

The grouping of breeds into classes may have no other basis than that of convenience, or as in the case of the "Miscellaneous" class, which is composed of three rather curious breeds, namely, Silkies, Sultans, and Frizzles, because they do not seem to fit anywhere else.

A complete list of chickens, turkeys, ducks, and geese, as recognized by the American Poultry Association and listed in the American Standard of Perfection, includes fifteen classes, sixty breeds, and one hundred and forty-nine varieties. Of these, twelve classes, forty-two breeds, and one hundred and twenty-one varieties are of chickens. There are eleven breeds of ducks, grouped in one class, and subdivided into fifteen varieties. The six breeds of geese are grouped as one class, only one of the breeds having two varieties. Turkeys are all of the same shape and so all along to the same breed, as well as to the same class. The breed is divided into six varieties on the basis of color, there also being in this case size differences between the varieties.



SPLASHED ANDALUSIAN

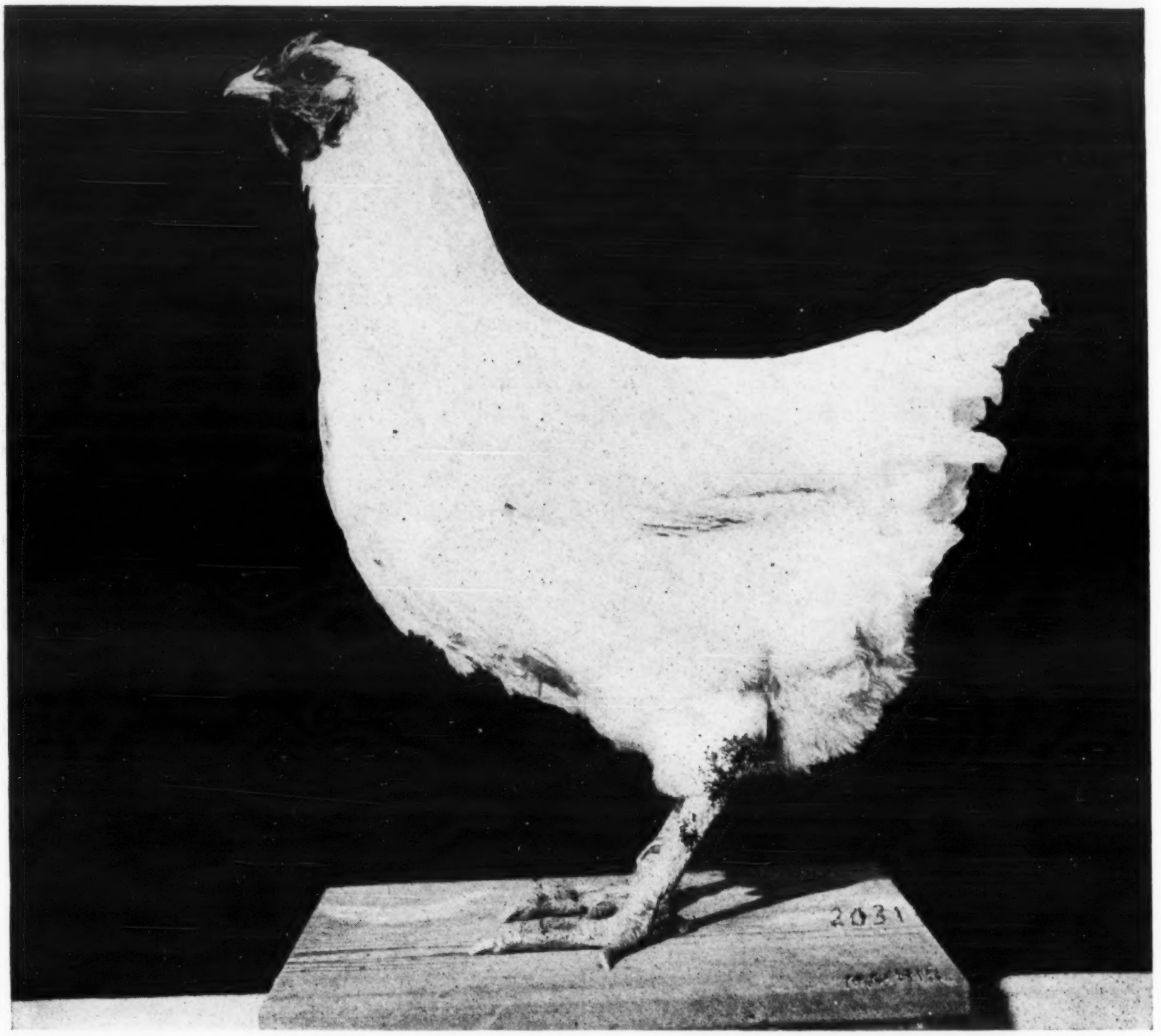
Splashed Andalusian, male (Kansas 57M). When mated with the White Wyandotte (Fig. 3) she produced four kinds of offspring with regard to color. These are shown in Figs. 13, 14, 15 and 16. (Fig. 11.)

While one of the rules laid down in the constitution (Article XI, Section 1) of the American Poultry Association[3] for the admission of a new breed or variety to the Standard of Perfection is that "it must be able to produce 50 per cent of the specimens reasonably true to the type and characteristics of the breed or variety, as set forth in the (its) proposed standard," as a matter of fact appearance and not pedigree is the criterion of poultry breeding. Very few poultry breeders keep careful and complete breeding records (though happily the number is steadily growing), and there are no official records.

Pen matings of one male and several females of individuals within the various breeds and varieties are usually made from year to year. If a bird is purchasd for breeding purposes, the buyer has only the word of the breeder and the appearance of the bird to assure him that the bird purchased has been bred pure.

As a matter of fact, however, poultry is, in all probability, nearly if not quite as "pure bred" as any other line of live stock, even though no breeding record, official or private, is kept. The types and colors could hardly be maintained without it. That the fact of

[3]American Standard of Perfection, 1910 edition, p. 328. Published by the American Poultry Association, Mansfield, Ohio.



WHITE WYANDOTTE

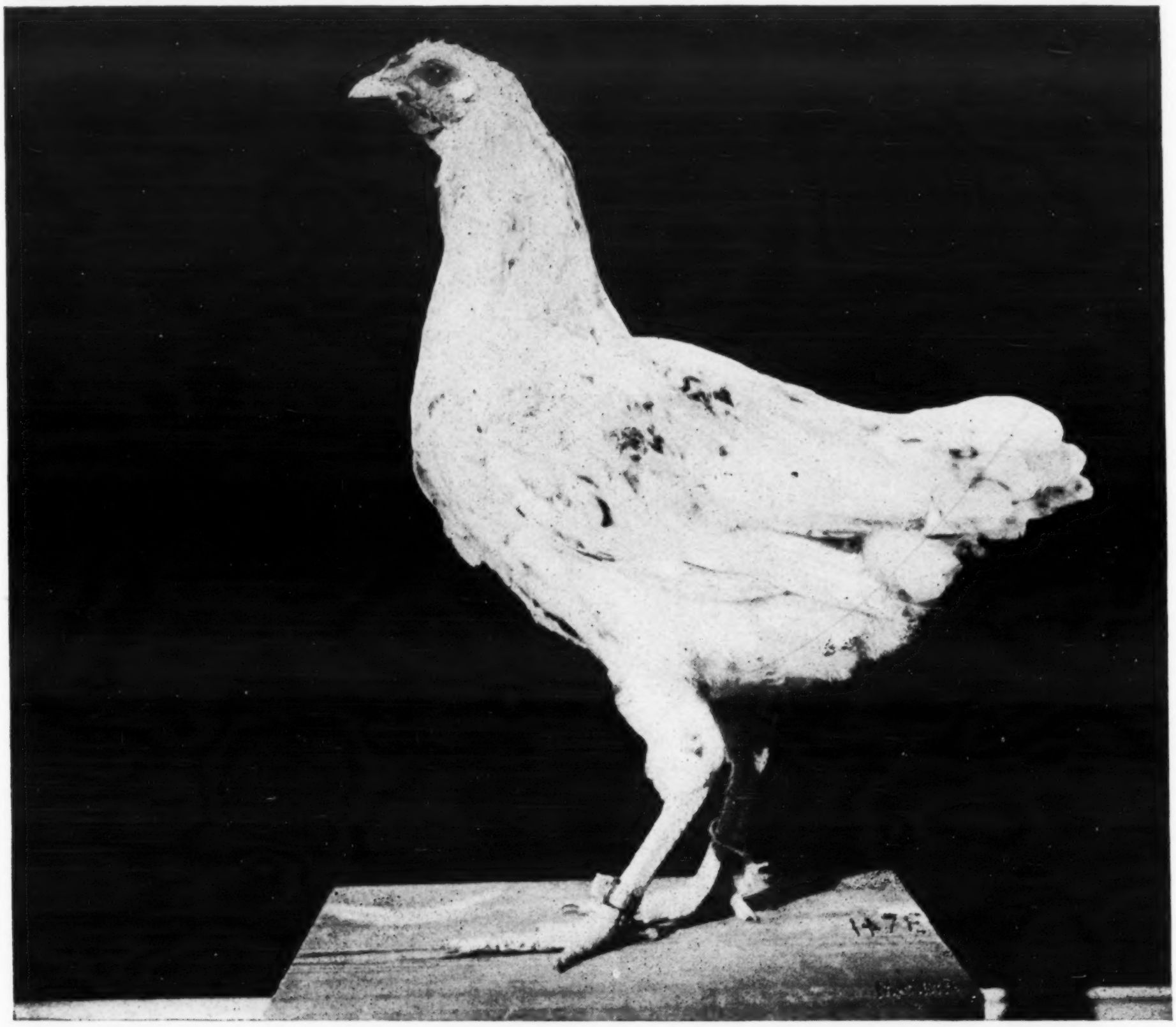
White Wyandotte, female (Kansas 2031). Though of a standard-bred family, she carried factors for "blue" and barring. Dam of birds shown in Figs. 13, 14, 15 and 16. (Fig. 12.)

official registry does not preclude impurity for certain characters is witnessed by the occasional appearance of red Berkshire hogs, red Holstein cattle and horned individuals in registered polled breeds of cattle. And it is quite possible that unsuspected factors usually present and considered desirable in some breeds may frequently be present in the germ plasm of others, but with no opportunity for expression.

That the appearance of an individual or even an entire breed may be far from telling what the real hereditary make-up is, is a matter of common observation by investigators. It was shown specifically in the case of poultry some years ago, by Hadley,[4] for the White Leghorn.

He found that many White Leghorns carried factors for both black pigment and barring, the expression of which was masked by the action of a dominant factor for white. It is obviously impossible to state that all White Leghorns carry these factors, but the condition seems to be quite general, as witnessed by reports from several widely separated investigators. So far as I am aware, no attempt has been made to

[4]Bulletins 155 and 161, Rhode Island Agricultural Experiment Station.



BARRED-SPLASHED MALE

Kansas 147E. Four kinds of offspring were produced from the male shown in Fig. 11 and the Female shown in Fig. 12: Barred splashed males; barred blue males, non-barred splashed females, and non-barred blue females. (Fig. 13.)

trace this condition to any particular racial ancestor.

A family of White Wyandottes has recently come under my observation which is interesting from the standpoint of purity of breeding. Members of this family have repeatedly won prizes in the larger shows of Kansas and Missouri and also at the Panama Exposition show, which was one of the largest ever held in this country. As a result they have been held in considerable esteem by Wyandotte breeders of the Southwest.

By way of explanation it may be said that the white of the White Wyandotte is recessive, as noted by Sturtevant,[5] probably being in the first place a white mutation from the pigmented Silver Wyandotte. The Silver Wyandotte is credited by Brown[6] as having been the product of crosses between the Sebright Bantam, from which it inherited its color, the Cochin and Hamburg, and possibly others.

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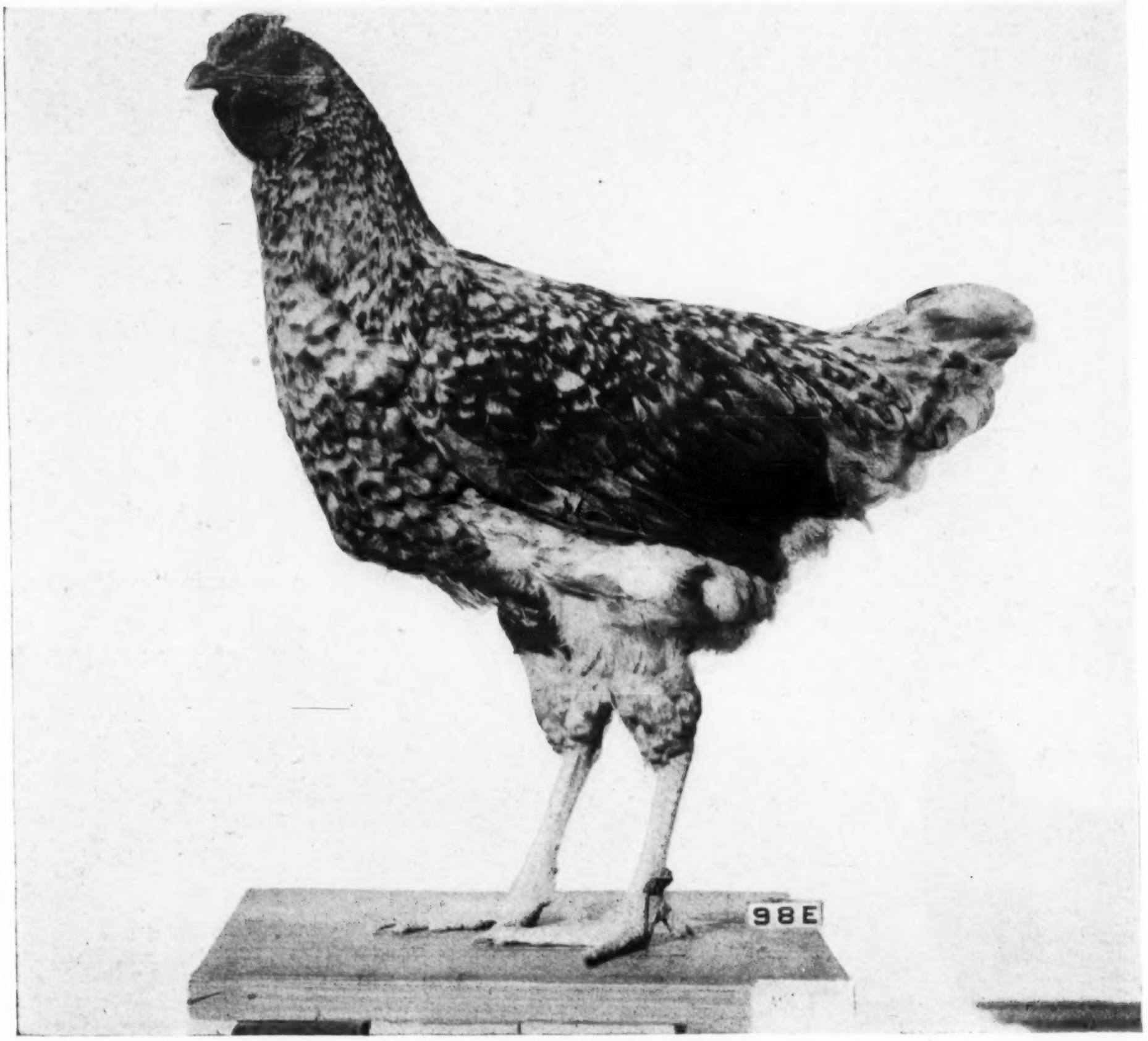
[5] *Journal of Experimental Zoology*, vol. 12, No. 4, pp. 499–518.

[6] "Races of Domestic Poultry," published by Edward Arnold, London, 1906, pp. 155–163



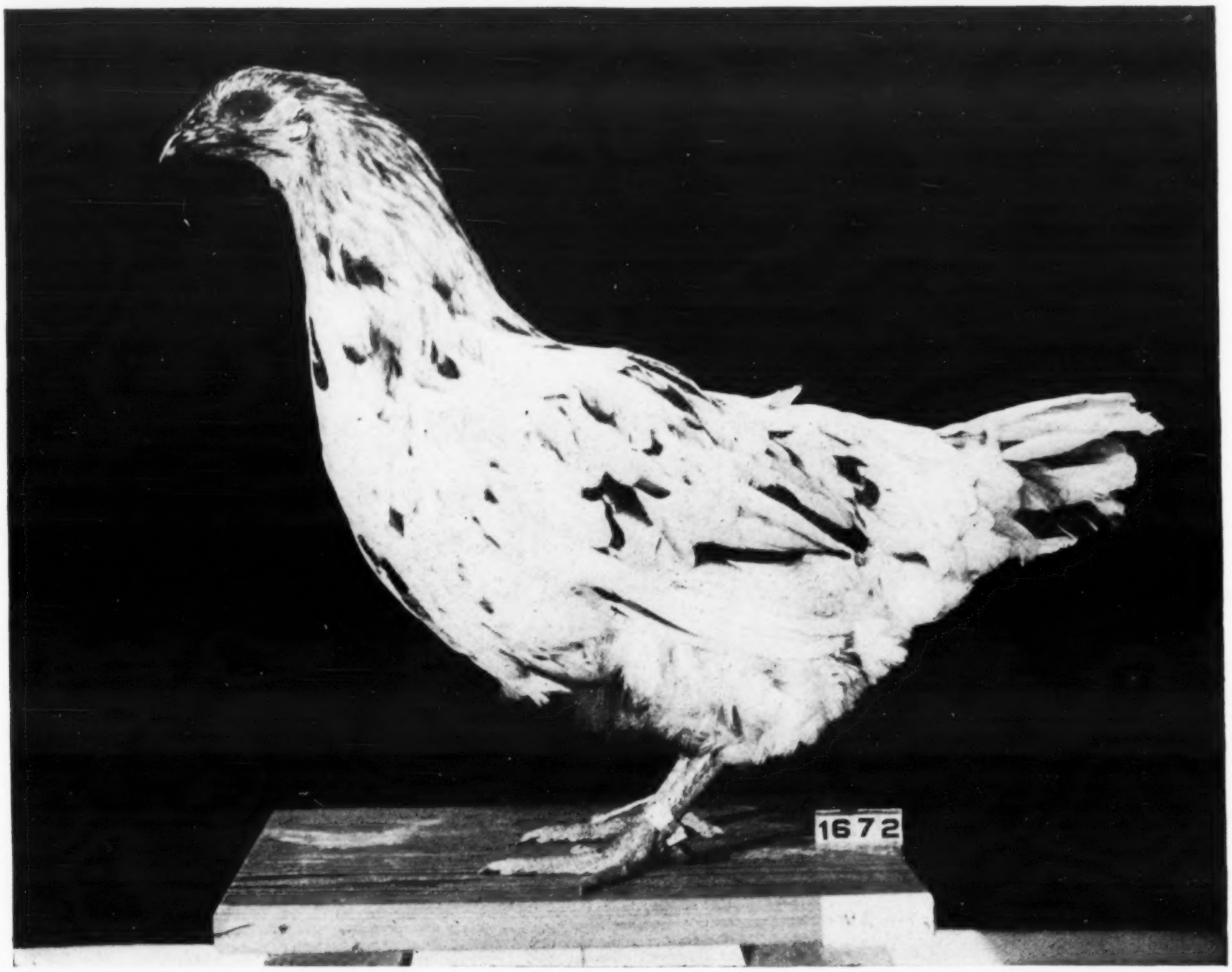
BARRED BLUE MALE

Barred Blue Male (Kansas 98E). Second of the four kinds of offspring produced, (see Fig. 13.) (Fig. 14.)

For some years occasional single comb segregates have been noticed in this family, two of which are shown in Fig. 10. Possibly this has come down from some of the breed's Cochin ancestors.

It was not, however, until several females from this family were crossed with males carrying black pigment during the 1918 breeding season that it was discovered that the family also carried the factor which, acting on black pigment, renders it bluish-grey in appearance as in the Blue Andalusian, and also the sex-linked factor for barring as found in the Barred Plymouth Rock and White Leghorn. Several individuals were found which carried the "blue" factor and one (Legband 2031), whose likeness is shown in Fig. 12, carried factors for both "blue" and barring. Several were also found which carried neither factor. Although as noted above, this family is more or less heterozygous in respect to comb, this particular individual's breeding behavior showed her to be homozygous for the comb character.

When mated with a Splashed Andalusian male (57M, Fig. 11) this female produced four kinds of offspring with regard to color. These were (1) barred



NON-BARRED SPLASHED FEMALE

Non-barred splashed female (Kansas 1672). Third of the four kinds produced by a cross between a splashed Andalusian male and a White Wyandotte female. (Fig. 15.)

splashed males (Fig. 13), (2) barred blue males (Fig. 14), (3) non-barred splashed females (Fig. 15), and (4) non-barred blue females (Fig. 16).

As previously suggested (Lippincott[7]), the splashed Andalusian is homozygous for a dominant factor for black pigment and for another dominant factor which, acting on black pigment, renders it bluish-grey in appearance. It lacks another dominant factor which is present in self blue, self black, and some self white races, which extends black pigment, if present, into all parts of all feathers of the body, giving a self color.

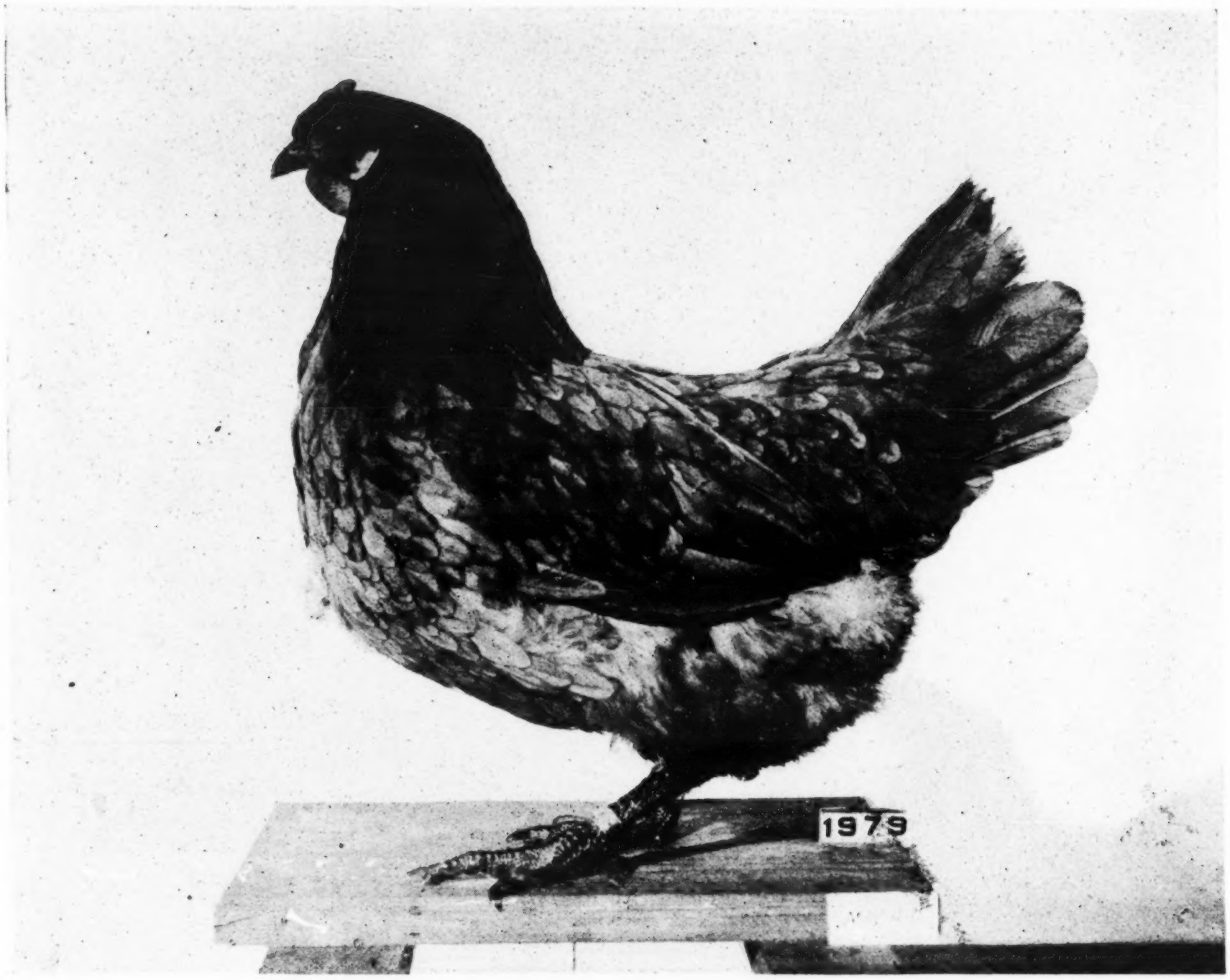
These last two factors may be true allelomorphs (*i. e.*, occupying identical loci of homologous chromosomes) or each may be closely linked to the recessive allelomorph of the other, a point as yet undetermined.

Assuming that the latter is the case, the genetic formula of a splashed Andalusion male, with regard to the characters in question is—

PP (Re)(Re) bb

where P = black pigment
P = white (no pigment)
(Re) = blue in presence of P (self blue if heterozygous [(Re)(rE)], splashed if homozygous [(Re)(Re)]
(rE) = self black if homozygous [(rE)(rE)] In presence of P, blue if heterozygous [(rE)(Re)] in presence of P.
B(sex-linked) = barring in presence of P.
b(sex-linked) = non-barring.
b = indicates lack of synaptic mate of B or b in the female

[7] *The American Naturalist*, vol. lii, No. 614, pp. 95–115.



NON-BARRED BLUE FEMALE

For ancestry, see Figs. 11 and 12. The principal interest in the case illustrated in Figs. 11 to 16 lies in the fact that a standard bred and supposedly pure bred family should carry factors normal to other breeds, and without being suspected. (Fig. 16.)

On the basis of her offspring when mated with a splashed Andalusian male the formula of White Wyandotte 2031 must be, with regard to the same characters—

pp (Re)(rE) Bb

Because this individual does not carry P she is white and neither (Re), (rE), nor B can find expression. However, when mated with a splashed Andalusian the theoretical result is as follows:

Photographs of the four kinds of individuals are shown herewith (Figs. 13, 14, 15 and 16). The expectation of equal numbers of each kind appears to have been closely approximated. The exact numbers are not known, inasmuch as the appearance of barring was entirely unexpected and a number of dead chicks had been counted in the down before the possibility suggested itself that the occipital spot which was appearing on the blue males was the

Splashed And. ♂ 57M
PP (Re)(Re) bb

White Wyandotte ♀ 2031
pp (Re)(rE) Bb

Offspring (1) Pp (Re)(Re) bB = Barred splashed ♂ ♂ *M*
(2) Pp (Re)(rE) bB = Barred blue ♂ ♂ *M* Equal
(3) Pp (Re)(Re) bb = Non-barred splashed ♀ ♀ *M* numbers
(4) Pp (Re)(rE) bb = Non-barred blue ♀ ♀ *M*

juvenile expression of the barring factor, as found in Barred Plymouth Rock chicks.

The principal interest in this case is the fact that a standard red and supposedly pure bred family should carry factors normal to other breeds, and without being suspected. How these factors found their way into the germ plasm is a matter of conjecture. It would appear unlikely that they should have been introduced through any of the known ancestors of the breed, but the history of the formation of the Wyandotte breed appears to be somewhat hazy, and this is a possibility.

There is also the possibility, perhaps the probability, that cross breeding has occurred at some time. The fact that some individuals of this family, and all of the few individuals of other families that have been mated in a similar manner, have not exhibited factors for these foreign characters, seem to favor the latter view. A cross with White Plymouth Rocks at some time in the past might account for both the single combs and the barring, since the latter variety is single combed recessive white and carries barring as a cryptomere. The "blue" factor appears to be more frequent in occurrence in this family than the barring factor. How or when it was introduced one can only guess.

Butter Fat vs. Body Fat

In 1906 a test of soiling crops was made involving the entire dairy herd of The Pennsylvania State College. The crops tested were rye, wheat, alfalfa, timothy and clover, oats, oats and peas, and corn. Among the points under observation were the effects of these various crops on the live weight of the cows, quantity of milk produced, and its fat content. The test involved thirty-one cows and extended from May 17 to August 28. Not all the cows were on test during the entire time, so the total number of observations was 173.

When curves were plotted showing the mean live weight and the mean fat content for the various periods it was found that "A gain in live weight is in every instance accompanied by a decrease in the per cent of butter fat, and a falling off in live weight in every case but one accompanied by a gain in the per cent of butter-fat.

Including the records of 1902 and 1904 with those of 1906, the only years when similar observations were made, it was found that "When the cows gained in live weight their milk fell off in richness and vice versa one hundred and fifty-three times out of two hundred and nineteen or almost exactly 70% of the cases."

At that time no attempt was made to work out the correlation. This has since been worked out and the correlation coefficient between increase or decrease in live weight and increase or decrease in fat content of milk for the 173 measurements of 1906 found to be .47 with a probable error of .039. The values in live weight were taken by 10-pound units and ranged from —40 to 40. The values in fat content were taken by 5% units and ranged from —2 to 2.

While the popular belief has been that cows placing fat on their bodies put less in the pail actual data to confirm it have been comparatively meager. The influence of feed upon fat content of milk has been pretty generally denied, but this test would indicate that some feeds tend to produce body fat while others either directly or indirectly increase the secretion of milk fat.—T. I. Mairs, *State College, Pa.*

BETTER AMERICAN FAMILIES II

The Story of a Family Belonging to the So-Called Middle Class Which in the Course of Generations Has Broken Up into Lines Differing Widely in Social Worth.

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"ALL that we win is a battle—lost in advance—with the irreversible phenomena in the background of nature." So exclaims one school of thinkers over the spectacle of dead and decadent civilizations, while the more hopeful view is voiced in some such phrase as follows: "First and foremost in the perpetuity of national life is the element of belief—an undying faith in human nature." In a previous paper we have already disclaimed any need for such general and impersonal laws of national development, finding the real motive power to lie in the interaction of certain personalities with new combinations of environal characters. These characters, which constituted the resources of the country, together with the new demands on the individual such as adverse climatic conditions, vast distances to be traversed, savage enemies, human and otherwise, have acted to bring to the fore and perpetuate through physical and social selection the trait-complexes best fitted to cope with these conditions. The process of Americanization was found to consist primarily in the establishment of standards by certain regnant personalities, and the more or less perfect approximation to these standards through education on the part of the people.

It is proposed in this paper to examine, more minutely than is usually done, this process of approximation as exemplified in the story of two immigrant families of something more than a century ago. Fortunately the sector of human development known as American history is narrow enough to permit a view in relation to the individuals which determined the dominating quality of its several epochs. We have not yet outgrown the pioneering period of our history; it only assumes new phases from decade to decade, not the least significant of its manifestations being the behavior of "young America" in the war just ended. However, for this study we will take the story of two families through five and six generations from their earliest planting on American soil. We shall try to trace the changes in social worth from generation to generation, both in relation to the economic and social opportunity enjoyed, but also in relation to the type of marriage its various members were able to make. We shall try to express their worth in terms of their leading traits and view their value as social assets as reaction between these traits and the environment. The study comprises nearly two thousand individuals, about one-half of whom are in the direct line of descent from two pairs of pioneers, the remainder being members of the families into which the direct descendants married.

It is estimating character and ability in the individual, chief reliance was placed on the "social test;" and by this was meant sufficient physical and mental soundness to understand the nature and possibilities of his surroundings, to react to them, to conceive social standards and bring his life in conformity to such standards. While the application of standard tests in a study of this sort

is highly desirable, the impossibility of using them on the majority of the persons studied made it inadvisable to use them at all. Moreover, the settled nature of the communities where they lived, with a fair sprinkling of intelligent historians, gave conditions of optimum value for the social test.

In the latter part of the eighteenth century there came to what was then the western edge of the American frontier an immigrant, whom we will designate as Aaron Rufer, with his wife and three small children. He was shrewd, honest, plucky and persevering. He never learned to read or write, but the conditions of his will, which he signed with a cross, show prudence and foresight. He acquired 400 acres of fertile land, which he farmed successfully for thirty years. Aaron's wife, Mary, was totally lacking in sense of number or quantity, for before he went to work in the morning he always measured out the proper amount of meat and vegetables for the family dinner; that done, Mary could tend the fire until a "sort of meal" was in readiness. Moreover, she could neither sew, spin nor weave acceptably, though she was obliging and faithful to the simple tasks she was able to perform.

From Aaron and his defective wife were derived seven children, five of whom were traced to the present generation. They are Isaac, faithful, plodding, with little ability to plan or calculate; Jared, shiftless and dishonest, with little ability to plan or calculate; Stephen, having a fair share of these traits, but non-aggressive, though he persevered in tasks set for him; and Darius, who resembled Isaac. Dorcas and Herman "didn't know anything at all." In his will, Aaron provides ample means and a guardian for them and "the old woman," the guardian to see that these children did not marry. Dorcas never did, but because Herman had been left a good farm, designing persons arranged a marriage with a feeble-minded, sexually lax girl "in order to give her a home." Their four children were very defective, two did not marry, but two married descendants of a couple to be described in the following paragraph.

Thomas and Martha Riel were settled in an adjoining county, where they owned a small farm. Both were very tall and had great physical endurance. Thomas came from a fair family but had certain irresponsible tendencies, which led him to slip away one night, leaving to his wife the care of the farm and their twelve children. The latter, too, were known for their great stature and strength, which in most of them was combined with extreme shyness, good nature and dullness. Two daughters married into stock of varied capacity, and their descendants made alliances with those of Aaron and Mary Rufer. Limited space forbids repetition of the anecdotes from which their characteristics have been derived, but stories like the following could be duplicated many times; Molly Riel, born about 1810, lacking as she was, was still superior to her husband in energy and planfulness, and all that the scanty acres yielded was owing to her. When the census-taker exclaimed at her family of twenty-one children and asked: "Are they all bright?" she nonchalantly replied: "Yes, tol'ably, considering how many the' is of them!" One of her sons, who never married, used to say in explanation: "I like Mam best. Lucky for Pap that he set eyes on Mam before I did; if I'd seen her first, Pap would sure never have got her." A photograph of her sister shows her to have been of large, powerful physique. When her neighbor's child fell into the well, she went down after it, climbing back with its dress held between her teeth, while with her hands and feet she clung to the sides. These two founded strains of widely differing potentiality. In early generations, mental development was very slow; many who were dubbed witless in their teens and twenties later managed their own affairs. And here, marriage into stocks showing a normal rate of development has apparently effected acceleration, so that the mental unfolding comes increasingly

early from generation to generation. Their lines cross those of Aaron and Mary Rufer, to an account of which we now return.

Isaac, the eldest son, married a woman of average ability who lacked sex control and came from a family showing nervous instability manifested largely in alcoholism. Their six children were very diverse, and through their marriages gave rise to branches (A in chart) widely divergent in respect to these traits. Their mentally deficient, immoral daughter, mating with a sexually loose man, had children with lack of sex control in the proportion of two out of three. Later unions with members of families showing higher ability to plan and calculate bring advance in these traits, but persistence of the lack of sex-control. Two members of generation III, who were superior in calculating ability and perseverance but low in aggressiveness, married into strains with an average of the traits, and the subsequent generations are considerably improved, except where a defective daughter, through marriage into a weak strain, carries on the defect in number and perseverance. The remaining members show a good average of social worth, considerably above that of three generations ago.

The wife of Jared, the second son, was able, but sexually lax. Their only daughter seems to have escaped the defects of both father and mother and to have founded a line B showing fair enterprise and morality. Line C was founded by the most able of the brothers, Stephen, and his able, aggressive wife, who came from stock having these traits in good measure. Subsequent marriages into good strains have brought complete elimination of the defects of the founders and corresponding economic worth. Line D, founded by Darius, who closely resembled Isaac, through marriage into sex-offending, alcoholic, criminalistic stock, has broken up into very degenerate branches. There have been a number of marriages here which were arranged as jokes by outsiders, one notably of an epileptic with an imbecile, which fortunately resulted in only one daughter, for twenty years an institutional case, the other children having died. The most degenerate branch arises where lack of number sense and low aggressiveness and perseverance mates with a low degree of these traits combined with sex offense. These defects persist in most of the offspring, but with industry in some cases, and sex control. However, none of the trait-complexes from these defective germ-plasms are such as to produce social fitness; we have, as a result, vagrancy, pauperism, prostitution and petty criminality. With one exception its representatives are all at large, a drain on the resources and a menace to the moral and economic development of their communities. Left to themselves, its degenerate members have gravitated toward degenerate offshoots of other mixed strains, their mating producing an accentuation of the defects of the parents.

The story of line E, founded by the imbecilic Herman, differs from the preceding in that there has been nothing but imbecility from the beginning. After three generations, in which the property has been dissipated, the surviving representatives are happily ending their days in a state institution. This is the line in which marriage has occurred with the defective descendants of Thomas and Martha Riel, the casual nature of which is illustrated by this episode. Walking along a country road a young girl met two boy acquaintances. "Come, let's get married," said she to one. He, however, demurred, whereupon the other one agreed to do so, and they went forthwith and were married. This mating resulted in five children, three of whom died of neglect; the other two were cared for in institutions at an expense of thousands of dollars.

To recapitulate, we have here one of nature's experiments in selective mating, experiments repeated over and over again, and ascertainable if we only give the needed careful study. All members carry defects. "We are none of us

perfect; no, not one." Are these defects relatively few, or so slight as not to seriously impair efficiency, the chance of making good these defects in marriage is correspondingly great. The trait is thus strengthened and remains so unless there is subsequent marriage into strains showing similar weakness or defect. This process has resulted in the practical blotting out of gross defect in three lines (A, B and C) of this net-work. On the other hand, when defect has been marked, or a combination of minor weaknesses has entailed social inadequacy, mating has usually occurred with those equally defective. Where these defects were similar we have a fairly uniform type of unfitness; where dissimilar, the result is a diversity of degenerate condition. This process is illustrated by lines D and E. Marriage was usually with early American stocks, and the sifting out which has thus occurred has brought about an approximation to the standards of the older stocks on the part of the newcomers, so far as their natural endowment permitted. The examination of eugenic conceptions operating in the various matings, the changes in educational and economic opportunity, which came as "accident" or because of the better endowment of the individual, are too long and detailed to be given here. It must suffice to say that the possession of the traits considered, in one way or other, usually operated to secure a greater range and better type of marriage selection. The better ones in consequence are continually pushing out into newer sections of the country, there developing its resources, while the weaker remain behind to mate together, accentuate defects and become a burden on the public. This is graphically shown in the diagram which gives the relation of the various lines to migration.

The story told here has been repeated many times in the history of American settlement. While, no doubt, the wife of Aaron was more defective than the vast majority of pioneer wives, and the level of most families belonging to the Riel group lower than the average, still the relative reaction of its various members to the educational and economic opportunity of their times remains the same. The diverseness in ability simply serves to throw the history of the lines into more vivid relief. There is a well-defined sentiment against marriage into the family in sections where the defective and degenerate members are found. On the other hand, the abler members of the mixed strains feel that stigma and seek to get away where the family is not known. It is related of one of them, that after living in the west for some years, he returned and sought to establish himself at the old home. The effort proving vain, he is said to have exclaimed: "Here I'm only a damned Rufer! I'll go back west where I am as good as anybody!" This he did, and now owns two ranches, is married and a school director, and the father of promising children.

We thus see how heredity, in conjunction with the physical and social selection imposed through the environal factors, operates to bring about concentration of positive characters in the rise of abler lines, who seek to approximate their enterprises and manner of life to the better standards established by the dominating personalities of the period. That the concomitant concentration of defect in other lines does not overwhelm the former process is due to the fact that the survival rate of the defective and degenerate families is below that of the abler families. This at least is true for the families studied here, and is illustrative of "Nature's method" of eliminating the socially unfit and insuring to the "fit" survival and all that survival entails. Where physical and social conditions pertain that encourage a reversal of this process, we have decadence and death.

GOOD QUALITIES ARE CORRELATED

Hope for the Eugenist, and One Objection Answered

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IT is often gratuitously stated that the aims of eugenists will be thwarted because individuals and families possessing rare and desirable qualities are likely, in other important ways, to be decidedly deficient. According to this theory, there is apt to be compensation in the allotment of human gifts. If "some are born fingers, and some are born thumbs," it is assumed that persons over-endowed with thumbs are nevertheless rugged and sturdy and probably staunch in moral fibre. This theory of compensation has been popularized by the emotionally appealing and widely read essay of Ralph Waldo Emerson, which bears the title "Compensation." The philosopher dealt chiefly with the problm of happiness and its dependant spiritual development, and here he may, or may not, be right. However that may be, it is a reasonable assumption that the work of Emerson, as well as that of hosts of other philosophers and preachers, is responsible for the notion that the poor, the sick, the stupid and the generally unfortunate are "the pure in heart," the hallowed possessors of divinely bestowed virtues.

That the exact opposite happens to be the truth, will not interest certain types of emotional and sentimental reformers; but persons desirous of promoting the science of heredity in its application to human problems may be interested in the evidence that accumulates from time to time, *all of which* points in one direction.

There is certainly a slowly growing mass of statistical proof that important mental and moral qualities are correlated. The number of researches is not very extensive, but they should not be overlooked. Most writers on eugenics appear to be unacquainted with the material bearing on this matter and seem thoughtless as to even the existence of such a question. Among authors who have recognized the significance of individual correlations in eugenic discussions may be mentioned E. L. Thorndike and latterly to some extent Popenoe and Johnson in "Applied Eugenics."

Thorndike in his chapter "Eugenics: With Special Reference to Intellect and Character,"[1] accepts the idea of a general correlation of superior and desirable qualities, and quotes Woods[2] as proving the correlation of intellect with morality, and morality with fecundity, in statistics gathered for measurements of royal families, but does not specifically mention subsequent researches, all of which lead to the view that the correlation of superior qualities is probably a general principle of nature.

Thorndike states the matter as follows:

"If we breed horses for speed, they are likely to lose in strength and vigor. Do we run such risks in breeding men for intellect, or for morals, or for skill? This question has been neglected by the hortatory type of enthusiasts for eugenics. It has not received the attention it deserves from the real workers for racial improvement, probably because the psychological investigations which answer it are little known. They do, however, give a clear and important

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[1] "Eugenics: Twelve University Lectures." New York, 1914.

[2] *Popular Science Monthly*, Oct. 1903, and "Heredity in Royalty." New York, 1906. Mental and moral correlation was found to be $r = .30$.

answer—that there is practically no chance whatever of injury from selective breeding within a race for intellect, or for morality, or for mental health and balance, or for energy, or for constructive ingenuity and skill — no risk that the improvement of any one of these will cause injury to any of them, or to physical health or happiness."

Among investigations tending to support this theory may be mentioned that of Krueger and Spearman, reported in the *Zeitschrift für Psychologie* in 1906. The tests made by these authors were five in number, and it should be noted that they were of a nature involving very dissimilar mental faculties. The five tests were as follows:

1. Distinction between pitches of given tones.
2. Combination of fragments of printed texts.
3. Establishment of the limits of the sense of touch.
4. Addition of figures.
5. Ease of committing to memory successive series of numbers.

In spite of the wide difference between having an ear especially sensitive to musical tones, and a brain quick at adding figures, the experimentees, who were brilliant in one of these five directions, were found on the average to be brilliant in the other four.

Recent confirmation of this theory is furnishel by W. H. Pyle in the September, 1918, number of the *Journal of Delinquency*. He shows, in his article "The Relation of Mental to Physical Development," that there is good evidence that brighter children are also both anatomically and physiologically superior to children of mediocre mentality and that they are physically superior to their duller schoolmates to an even greater degree.[3]

The same issue of the *Journal of Delinquency* has further evidence bearing on the question of correlations within individuals. Willis W. Clark, who is a field-worker in the Whittier State School for Truants, Whittier, California, finds that one-fourth of the white, one-half of the colored, and one-half of the Mexican Indian boys, committed to the school were definitely feeble-minded. Only 17.7 per cent of the total number committed were of average-normal or superior intelligence.

Further proof is to be found in the July number of *Mental Hygiene* (page 445). Here Jessie D. Hodder, Superintendent of the Reformatory for Women, Framingham, Massachusetts, presents statistics which show a slight though measurable correlation between intellectual superiority and freedom from nervous defect. All of the 5,310 cases were women committed to the institution for some form of criminality. The author has classified these individuals into six grades for mentality, (imbecile, moron, subnormal, dull, fair, and good). The method used in classifying is not given, but inasmuch as the material is presented for a purpose other than proving that good qualities are correlated, we may assume that the author has no bias towards such a theory, and we may at least examine the statistics from this standpoint. The percentages of these criminal women who show some form of nervous or mental defect is very high (63.6 per cent) and is itself a manifestation of the joining together of bad qualities. Furthermore, if we sum up the two highest classes in mental grades we find 1,837 persons showing only 39 per cent free from nervous defect, while the three lowest mental classes, 2,390 in number, give an even worse record, or only 34 per cent, free from some one of the four forms of defect here classified under the categories, neuropaths, psychopaths, epileptics and hysterical.

Psychologists have also made tests upon school children and college stu-

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[3] See also "Body and Mind," in the JOURNAL OF HEREDITY for June, 1917, Vol. viii, p. 286.

dents. The results are summed up in the following quotation,[4] "He who can learn better than the average through the eyes, tends to learn better than the average through the ears; also he who can attend to one thing better than all other men, will be able to attend to many things at once, or in rapid succession, better than most of them. Artistic ability, as in music, painting, or literary creation, goes with scientific ability and matter-of-fact wisdom. The best abstract thinker will be above the average in concrete thought also. The rapid workers are the most accurate. Intellectual ability and moral worth hang together.

The correlations are, of course, not perfect. A large degree of superiority in one desirable trait may involve only a slight superiority in many others. And since the relations vary enormously amongst individuals, a person highly gifted in one respect will often, though not usually, be very inferior in others."[5]

Thus we see that most of the really important characteristics of human beings—such unquestionably desirable attributes, from the common-sense point of view, as health, intellect and morality (here meaning all virtues in their widest sense) are strongly correlated. Special aptitudes are also correlated. More than this, net fertility is correlated with morality and consequently, to some extent, with intellect also. Furthermore, net fertility has been found to be correlated with longevity, which is itself hereditary to a very great extent.[6]

All these facts warrant us in assigning an immence importance to the whole principle of *correlations within the individual,* and they present a little appreciated though very optimistic outlook for the future of eugenics.

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[4] Thorndike, Edward L.: "Individuality," Riverside Educational Monographs. Boston: Houghton, Mifflin, 1911.

[5] See also B. R. Simpson: "Correlation of Mental Abilities," Teachers' College, Columbia, 1912, p. 122.

[6] Beeton, Miss M., Yule, G. V., and Pearson, K.: "On the Correlation Between Duration of Life and the Number of Offspring," Proc. R. S., London, Vol. LXVII, 1900, pp. 159-171. The material consisted of English and American Quaker families. Also Bell, A. G.: "The Duration of Life and Conditions Associated with Longevity." Washington, 1918. 57 pp.

RESTRICTED ENTRY OF PLANTS TO PROTECT AMERICAN CROPS

No Plants Completely Excluded by New Quarantine—U. S. Department of Agriculture Explains Reasons for Far-Reaching Regulations Which Go into Effect June 1, 1919.

WASHINGTON, D. C.—The effective date (June 1, 1919) of Plant Quarantine No. 37 will mark the operation of new and strict regulations governing the importation into the United States of plants and plant products. The quarantine order has been promulgated by the Secretary of Agriculture to check so far as possible the introduction of more dangerous crop enemies. Experts of the Department of Agriculture estimate that the losses caused by the pests already introduced, for the most part through the agency of imported plants, aggregate half a million dollars annually.

Important provisions of the new quarantine are as follows:

"Requires permits and compliance with regulations for importation of lily bulbs, lily-of-the-valley, narcissus, hyacinths, tulips, and crocus; stocks, cuttings, scions, and buds, of fruits for propagation; rose stocks for propagation, including Manetti, Multiflora, Brier Rose, and Rosa Rugosa; nuts, including palm seeds, for propagation; seeds of fruit, forest, ornamental, and shade trees, seeds of deciduous and evergreen ornamental shrubs, and seeds of hardy perennial plants.

"Leaves unrestricted, except in special cases, importation of fruits, vegetables, cereals, and other plant products imported for medicinal, food or manufacturing purposes; and field, vegetable, and flower seeds.

"Excludes, except as noted in next paragraph, all other classes of plants for propagation, including fruit trees, grapevines, bush fruits, grafted and budded roses, forest, ornamental and deciduous trees, ornamental and deciduous shrubs, pine trees of all kinds, broad-leaved evergreens (such as azaleas and rhododendrons), and a long list of plant material commonly known as florists' stock.

"Excluded plants may still be imported through the agency of the Department of Agriculture, in limited quantities to supply the country with novelties and necessary propagating stock, such entry being safeguarded by the highly-developed inspection and quarantine service which has been organized by the department."

The conditions of entry of these various classes of plants and plant products are given in the regulations under the quarantine. A news letter giving more detailed explanation of the conditions governing importations still permitted, shortly will be sent by the Department of Agriculture to all horticultural, nursery and florist trade journals.

Quarantine No. 37 represents years of careful consideration given to the subject by the experts of the Department of Agriculture, and of the several States, and of the interests concerned, followed by a public hearing, and subsequent further investigation and consultation with the principal nurserymen and florists of this country. The quarantine, therefore, embodies the best judgment of the plant experts of the department, and of the several states, concurred in by most of the interests engaged in actual plant production. It voices the belief that the policy of practical exclusion of all stock not absolutely essential to the horticultural, floricultural and forestry needs of the United States is the only one that will give adequate protection against additional introductions of dangerous plant diseases and insects.—*U. S. Department of Agriculture.*

INBREEDING LIVE STOCK[1]

DR. G. PUSCH.

The author reports experimental work in inbreeding Toggenburg and Erzgebirge native goats, and in inbreeding Friesian milk sheep. In the experimental work with goats Pusch used 18 females and 9 males, making 42 matings and obtaining 77 offspring. With the sheep he used five ewes and one ram, making five matings and producing nine lambs.

The system of breeding followed by Pusch with the goats was the mating of a particular female with her sons for several generations, thus greatly intensifying the blood line and making the animals very closely related.

EFFECTS APPARENTLY DYSGENIC

From two matings of a Toggenburg mother and son two goats were produced that developed very badly and showed chronic dizziness when mature. A mating between daughter and sire produced a kid of low vitality and with chronic dropsy, confirmed by post-mortem examination.

The effect on the numbers of offspring produced was noticeable with this very close inbreeding. The kids became lighter in weight and also more defective in body development. The addition of the blood of another though still closely related line increased the number of offspring produced, but this increase soon disappeared when the close inbreeding was again practiced.

He reports one case in the Erzgebirge gray goats in which a female goat was mated with her son producing Bruno 1. Bruno 1 mated with his dam produced Bruno 2, and Bruno 2 mated with his dam produced Bruno 3. From the first mating with her son she gave birth to four kids. Of the four progeny produced from this mating, one was smothered while young, one was sterile as a male, and the other two were most excellent individuals in every way. The same Erzgebirge was mated four times to a Toggenburg male. Three of the matings produced two kids each, and one mating produced three kids.

Five matings between brothers and sisters in which five females and three males were used showed most unfavorable results. From these matings six kids resulted of which one was sound, one epileptic, two born dead from different mothers, one rickety, and one showed very unsatisfactory development.

In all the close inbreeding only one goat did not become pregnant by her son. She was proven to be fertile by the fact that the next year she bore a kid from another male. Her son was likewise fertile with other females. In several cases there was recognized a distinct inclination to osteomalacia (defective mineral metabolism in the bones) in the offspring from close mating, although care was taken to give the animals proper feed and abundant opportunity to exercise.

INBREEDING GIVES POOR RESULTS

In these experiments brother and sister, sire and daughter, and dam and son matings gave much more unsatisfactory results than cross breeding, line breeding, and moderate inbreeding.

The work with the goats he summarizes as follows: Twelve cross-bred matings gave 26 kids, 25 strong, 1 inferior (3.85%). Nine line bred matings, or moderate inbreeding, produced 18 kids, 15 satisfactory, 3 inferior (16.67%). Twenty-one very close matings produced 33 kids, 15 satisfactory, 18 inferior (54.50%).

Pusch summarizes his results with

[1] Translated from the German by F. A. Hays, Delaware College Experiment Station, Newark, Delaware.

sheep as follows: The first four close matings gave seven lambs of good conformation and development. Cross breeding, on the other hand, gave two lambs which did not develop well.

Summary.— Inbreeding creates homozygous germ plasm, producing animals that breed true, and tends to produce uniformity in the breed. Deliberate and moderate inbreeding has proved itself necessary and useful in live stock improvement, and the reproductive capacity has been favorably influenced thereby.

GENETICALLY SUPERIOR STOCK NECESSARY

Success in inbreeding is only possible where breeding stock has a strong constitution and perfect health. It is not successful in breeds that are too highly refined, and the feeding and shelter must be given careful attention. According to Pusch, if the above conditions are not fulfilled, the offspring from close matings may be over-refined in skeleton, giving small yields of milk, lacking in vitality, and showing low fertility. Existing defects make inbreeding especially dangerous. The certainty of inheritance applies to the defects as well as the strong points of the animals. Inbreeding, therefore, requires continued and careful study of the herd.

Very close inbreeding should be recommended only when special considerations justify and when the breeder is fully conscious of the possible outcome. There is an increasing tendency to discourage such a method in Germany. Moderate inbreeding and line breeding have been used to good advantage in Germany. Carelessness in matings and improper maintenance of the animals have greatly increased the dangers from inbreeding. Inbreeding as a practice can only be carried on profitably where all undesirable traits have been avoided in the breeding stock.

Heredity of Cancer

It is, of course, only in accord with common observation that tumors may develop into sarcomata or other malignant types of growth. The fact that multiple fibroneuromata do so bears on the question of "heredity of cancer," which is so much discussed.

This question is a perennial one. Of late it has come to the fore because of the doubt cast upon heredity of cancer by life insurance actuaries and statisticians using the method of mass statistics. On the other hand, new evidence for the inheritance of cancer has come from the experimental pathologists who all agree that in mice there are strains that cannot grow cancers and others in which they grow rapidly. The hereditary behavior of such strains has even been investigated experimentally by Tyzzer and Little. Now the cancers of mice are so entirely like those of man that it is extremely probable that if the one has an hereditary basis the other has also.

Another reason for the view that cancer is hereditary is that there are races of men who are almost immune to cancers, such as the American Indian, full-blooded negroes and some aborigines of Australia and the Pacific Islands. Also, there are racial peculiarities in the organs affected by cancer; among the Japanase women cancer of the generative organs is about as common as in Great Britain, but cancer of the breast only one-tenth as common. Also, we cannot overlook the significance of such facts as that of the occurrence of sarcoma of the eyeball in three generations in the direct line and four individuals of the middle generation of this family (Silcox, 1892).

Finally, the fact of cancer villages, where there has been much intermarriage, is strong additional evidence of the racial significance of liability to cancer. In view of all these considerations we must consider the presence of an inheritable factor in cancer as practically certain. But we are, neverthelss, very far from a knowledge of the law of its inheritableness. That is a matter for future investigation.—*Eugenics Record Office Bulletin*, No. 19, October, 1918.

RACE MIXTURE IN HAWAII

(Second Series)

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PORTUGUESE AND SPANISH

THE first paper of this series dealt with the Chinese, the Japanese and the Koreans. Portuguese were imported as laborers for the sugar plantations, the principal influx occurring about 1880. They stand second only to the Chinese in length of residence in Hawaii, and now constitute the chief "white" labor. In the case of both Portuguese and Spanish a large percentage (50% or more) of the original immigrants have been dissatisfied with conditions of labor in Hawaii and have emigrated to California. Most of the Portuguese were imported, at the expense of the Government or planters, from Madeira and Fayal. The immigration of foreign-born Portuguese into Hawaii, to 1910, has been as follows:

Previous to 1890	5000
1891–1895	470
1896–1900	215
1901–1905	110
1906	425
1907	1,215
1908	140
1909–1910	780

There has been little immigration since 1910. At present there are about 24,000 Portuguese in Hawaii, 3,400 of whom are laborers on the sugar plantations. In 1917 there were about 6,000 Portuguese children in the schools; they comprise 15% of the total school enrollment and exceed all other nationalities except the Japanese.

The Portuguese have about 3,000 registered voters in Hawaii and comprise politically the best element in Hawaii's diverse immigrant population.

The marriages during a typical five-year period (see previous paper for data) have been as follows:

FULL-BLOODED PORTUGUESE

Nationality of mate	*Men*	*Women*
Total marriages	1,139	1,463
Portuguese	991	991
American-Portuguese	0	1
British-Portuguese	1	12
German-Portuguese	2	0
Swedish-Portuguese	1	0
Norwegian-Portuguese	1	0
Spanish-Portuguese	1	1
Mexican-Portuguese	1	1
Italian-Portuguese	0	5
Chinese-Portuguese	4	2
Japanese-Portuguese	1	0
Spanish	20	20
Italian	0	1
Greek	1	0
French	6	0
Galician	1	2
Mexican	1	0
American	6	194
British	3	15
Norwegian	1	4
Swede	0	4
Dutch	0	1
Dane	0	2
German	4	16
German-Spanish	1	0
Austrian	1	1
Russian	3	4
Chinese	0	11
Japanese	0	8
Korean	0	9
Filipino	2	58
Porto Rican	3	24
Hawaiian	40	31
Caucasian-Hawaiian	34	24
Chinese-Hawaiian	13	8
Japanese-Hawaiian	1	0
South Sea Islander	0	1
Other nationalities	1	6

SUMMARY

1. The majority of Portuguese men marry Portuguese. Their national preferences, outside their own group, in quantitative sequence are: Hawaiian, Caucasian-Hawaiian, Spanish, Chinese-Hawaiian.

2. No Portuguese men married full-blooded Oriental women (Chinese, Japanese, Koreans). Only 2 married Filipinos, whereas 58 Portuguese women married Filipinos; 19 Portuguese men married part-Oriental women.

3. Of the total marriages, both men and women, 174 were with mates of Polynesian or mixed Polynesian stock; 259 were with mates of American or North European stock; 67 were with mates of South European stock (aside from Portuguese).

4. Among the other significant figures, from the standpoint of race-mingling, are these: 194 Portuguese women were married by Americans, 58 by Filipinos, 28 by Orientals, 24 by Porto Ricans, 63 by Hawaiians or part-Hawaiians.

5. An appreciable percentage of Hawaii's population is more or less infused with Portuguese blood, as witnessed by the marriages of full-blooded Portuguese men and women with mates of mixed Portuguese blood.

PART PORTUGUESE

1 Portuguese-Spanish woman married a Mexican.
1 French-Portuguese woman married an American.
1 German-Portuguese man married a Cauca ian-Hawaiian.
4 German-Portuguese women married Americans.
3 German-Portuguese women married Germans.
2 German-Portuguese women married Caucasian-Hawaiians.
1 Norwegian-Portuguese woman married a German.
1 Danish-Portuguese woman married a Caucasian-Hawaiian.
2 British-Portuguese women married Americans.
1 British-Portuguese woman married a Swede.
2 Chinese-Portuguese women married Norwegian-Portuguese.
1 Chinese-Portuguese woman married a Spaniard.
1 Chinese-Portuguese woman married an Italian-Portuguese.
1 Chinese-Portuguese woman married a Caucasian-Hawaiian.
1 Japanese-Portuguese man married a Japanese-Portuguese.
1 Japanese-Portuguese woman married a Korean.

These tables testify to a remarkable breaking-down of "race barriers" in Hawaii. The intermarrying of the Portuguese with other peoples in Hawaii is only exceeded by the Hawaiians and the Americans. It is unfortunate that we do not possess detailed accurate eugenic data concerning the progeny of these unions.

THE SPANISH

The Spanish in Hawaii are very much like the Portuguese in character, intellect, economic and social status. There are only about 3,000 Spanish, many of the original immigrants having "gone to the coast." Practically all were imported originally to furnish cheap field labor for the sugar plantations. The Spanish school population has decreased in recent years; it comprises less than 2% of the total school enrollment.

MARRIAGES, FULL-BLOODED SPANISH (5-YEAR PERIOD)

Nationality of mate	*Men*	*Women*
Total marriages	207	269
Spanish	177	177
Portuguese	18	20
Porto Rican	5	11
Filipino	0	25
Hawaiian	2	0
Caucasian-Hawaiian	1	3
Chinese	0	1
Chinese-Portuguese	0	1
Japanese	1	0
Korean	0	10
American	0	10
British	0	4
French	0	1
Greek	0	1
Norwegian	0	1
German	0	1
Russian	2	
Other nationalities	1	

1 Portuguese-Spanish woman married a Portuguese.
1 Portuguese-Spanish woman married a Norwegian.
1 British-Spanish man married a Caucasian-Hawaiian.
1 British-Spanish woman married a Briton.
1 German-Spanish man married a Portuguese.
1 Indian-Spanish woman married an American.

SUMMARY

1. Most Spanish men married Spanish women. Spanish women marry freely outside their nationality.

2. A small amount of intermarrying takes place between Spanish and Portuguese.

3. A notable number of Spanish women are married by Porto Ricans and Filipinos.

4. The intermarrying between Spanish and Hawaiian and part-Hawaiians is very slight, especially when contrasted with the Portuguese in this regard.

5. Practically no Spanish men marry Oriental women; ten Spanish women were married by Koreans.

6. Practically no Spanish men marry Americans or Europeans (except Portuguese). Spanish women have been married by Americans and Europeans.

THE NATIVE HAWAIIANS

The primitive Hawaiians were Polynesians, and part of the splendid Maori-Samoan-Hawaiian brotherhood. This group comprised one of the finest physical types known in the history of the human race. For a detailed account of the primitive Hawaiian physique, see the author's "Physique of the Ancient Hawaiians" in the *Scientific Monthly*, 5: 166-74, August, 1917.

The present paper cannot deal with the successive tragic stages in the extinction of the ancient Hawaiian, nor can it analyze the complex and inexorable factors that so rapidly consumed this noble race. In 1778 there were probably no less than 300,000 native Hawaiians, the sole inhabitants of "the loveliest fleet of islands that lies anchored in any ocean." Five decades later, in 1823, the census showed only 142,000. At the close of another decade the native population had dropped to 130,000. The next interval of thirty-six years witnessed a frightful decrease of two-thirds of the total population, reducing the natives to 44,000. In 1900 there were but 30,000; the past eighteen years have probably cut this nearly in half. The official figures of the Board of Health give 26,000 native Hawaiians for 1910 and about 23,000 for 1917, a decrease of 3,000 in seven years. All of the above figures are for full-blooded Hawaiians. The part-Hawaiian population is given as 12,500 for 1910 and 16,000 for 1917, a marked increase, which is growing steadily from year to year. It should be noted that a very considerable percentage of the persons listed as "native Hawaiians," especially in later years, are not full-blooded Polynesians. The natives have married, with startling promiscuity, both in and out of wedlock, with all the motley hordes who have come to their shores. Today it is practically impossible to determine pure lines of descent. There are probably not 10,000 pure-blooded Hawaiians living today.

The first two gifts of the white man to the Hawaiian were alcohol and venereal disease, and these have been powerful agents in the demoralization of the race. Other introduced bacterial diseases—plague, measles, leprosy, tuberculosis, pneumonia, etc.—have horribly ravaged these susceptible people. Foreign clothing, unsanitary housing, immorality grossly encouraged by a certain portion of the white population, and an economic system to which the Polynesian was absolutely unadapted—these factors have all contributed to wipe out a human type that had many physical, mental and spiritual attributes of lovely and superior quality.

The marriages of the Hawaiians and part-Hawaiians, during a typical five-year period (see previous paper for data) are tabulated on (Table I) opposite page. The period, 1913-1917, is the same throughout the papers in this series, so that the data are comparable.

SUMMARY

1. Most Hawaiian men marry Hawaiians. Hawaiian women marry freely outside their own race.

2. Notable among the racial preferences of Hawaiian men are their marriages with Caucasian-Hawaiians, Chinese-Hawaiians, and Portuguese.

3. Hawaiian women were selected by the following nationalities, in order: Hawaiian, Caucasian-Hawaiian, Chinese, Chinese-Hawaiian, American, Filipino, Korean, Portuguese, Japanese.

4. Of special note is the large amount of intermarrying between the various

TABLE I

Nationality of mate	Hawaiian		Chinese-Haw'n		Caucas-Haw'n.	
	Men	Women	Men	Women	Men	Women
Total marriages	1,256	1,694	173	240	444	625
Hawaiian	1,007	1,007	82	72	144	124
Chinese-Hawaiian	72	82	27	27	36	47
Japanese-Hawaiian	0	3	0	1	1	3
Korean-Hawaiian	0	0	0	1	0	0
Filipino-Hawaiian	0	0	0	0	1	1
Caucasian-Hawaiian	124	144	47	36	197	197
African-Hawaiian	1	0	0	0	0	0
Hawaiian-Alaskan	0	2	0	0	0	0
South Sea Islander	2	1	0	0	0	0
Chinese	4	140	7	59	1	27
Chinese-Portuguese	1	0	0	0	1	1
Japanese	2	27	0	1	2	4
Korean	0	52	0	5	0	2
Filipino	1	65	0	4	1	4
Spanish	0	4	0	0	3	1
Portuguese	30	40	8	15	24	34
Porto Rican	0	3	0	0	1	0
American	6	78	1	15	19	136
British	0	17	0	1	4	18
British-Spanish	0	0	0	0	0	1
French	0	0	0	0	1	2
Italian	0	0	0	0	1	0
Swiss	0	1	0	0	0	0
German	0	16	0	2	3	19
German-Portuguese	0	0	0	0	2	1
Austrian	0	1	0	0	0	0
Belgian	0	0	0	0	0	1
Dane	0	1	0	0	0	0
Norwegian	1	4	0	0	1	2
Swede	0	4	0	1	0	4
Russian	1	0	1	0	1	0
Other nationalities	3	0	0	0	0	2

European stocks and the Hawaiian and part-Hawaiian, giving rise to an unique European-Polynesian-Asiatic blend.

5. Two hundred and fifty-five Americans married Hawaiian or part-Hawaiian mates; of these 26 were American women.

6. In view of the fact that Japanese comprise over 50% (over 100,000) of the total population of Hawaii, the almost negligible degree of intermarrying with the Hawaiian stock is extraordinary. Only 4 Hawaiian or part-Hawaiian men married Japanese women, and only 32 Japanese men married Hawaiians or part-Hawaiians.[1]

[1] A valuable sociologic and eugenic analysis of the Hawaiian-Caucasian-Chinese blend has been made by Ernest J. Deece (*Amer. Jour. Sociology*, 20: 104–116, July, 1914). The reader is referred to this very interesting and suggestive paper, with the conclusions of which the present writer fully agrees.

Those readers who are interested in the decline of the Hawaiian people are referred to W. F. Blackman's "The Making of Hawaii," for much instructive sociological data.

AMERICANS, BRITISH, GERMANS

The "white" population of Hawaii numbers about 25,000, classed as follows:

Army and Navy	7,000
Americans, civilians	16,000
British	1,000
Germans	1,000

During the period following the discovery of Hawaii by Captain Cook (1778), British influence became pronounced, and many English and Scotch came to Hawaii. At the present time many of the old plantation managers are Scotchmen, and before the war there was a slender but constant migration from Scotland to Hawaii. In Vancouver's time the Hawaiian chiefs ceded the islands to Great Britain, but this action was not ratified by Parliament.

The political destinies of Hawaii were sealed by the arrival of the American missionaries in 1820, and the development of the North Pacific whaling industry in later years. For over a century Americans have shaped and controlled the life of Hawaii. During the middle of the nineteenth century, when Prussia began her futile dream of world-empire, German trading stations were established in Hawaii. With the rapid growth of the sugar industry these posts became powerful commercial agencies of strategic Pan-Germanistic value. This fact was demonstrated during the recent war, during which the German-"American" community of Hawaii was a veritable hotbed of espionage, disloyalty, treason, and criminal acts. Virulent disease germs were secretly disseminated under direction of the German consulate, and were only controlled by the prompt and drastic action of the territorial authorities.

The preceding brief sketch will indicate the origin and character of the American, British, and German groups in Hawaii. Most of the industrial, financial, mercantile, and professional leadership in Hawaii resides in the American-British group. A considerable percentage of the German colony is of low-grade peasant origin and ranks with the Spanish and Portuguese. Table II (page 95), showing marriages during the five-year period 1913-1917, is similar to those of previous papers in this series and the data are comparable.

SUMMARY

1. Only one-half of the American men married Americans; most of the American women married Americans. In numerical order, American men married Americans, Portuguese, Caucasian-Hawaiians, Hawaiians, British, German, Chinese-Hawaiians, and Porto Ricans.

2. Only 13 American men and 3 American women married Asiatics; 15 American men married Chinese-Hawaiians; 223 married women of Hawaiian or part-Hawaiian blood.

3. The 116 American women who did not marry American men married, in order: British, Caucasian-Hawaiians, Germans, Hawaiians, Portuguese.

4. British men married, in order: Americans, British, Caucasian-Hawaiians, Hawaiians, Portuguese, German, Norwegian. British women married, in order: British, Americans, Caucasian-Hawaiians, German, Portuguese.

5. Most Germans married others than Germans; in order: American, Caucasian-Hawaiians, Portuguese, Hawaiians, British.

6. These tables show the definite blends that are occurring between American-British-German stocks and such stocks as the Hawaiians, part-Hawaiians, and Portuguese. The direct blending with Asiatic stocks is almost negligible, although considerable intermixture is taking place via the Chinese-Hawaiians.

From the eugenic standpoint there can be no doubt that many, if not most, of the intermarriages of the American and North European stocks with dark-skinned peoples are *biologically wasteful*. The Englishman, for example, who marries a Hawaiian, a Hindu, or a Chinese, may have offspring of superior quality, but most of the Caucasian-Hawaiians seem to blend the least desirable traits of both parents. The English-

TABLE II

Nationality of mate	American		British		German	
	Men	Women	Men	Women	Men	Women
Total marriages	1,089	640	206	126	109	71
American	524	524	63	49	9	19
American-Portuguese	0	0	1	0	0	0
British	49	63	58	58	4	9
British-Portuguese	2	0	0	0	0	0
British-Spanish	0	0	1	0	0	0
French	10	0	4	1	1	0
French-Portuguese	1	0	0	0	0	0
Galician	2	0	1	0	0	1
Greek	0	0	1	1	1	0
Italian	0	0	1	0	0	0
German	16	8	9	3	2	25
German-Portuguese	4	0	0	0	3	0
German-Japanese	1	0	0	0	0	0
Austrian	3	1	0	1	5	2
Dane	3	0	0	1	0	0
Dane-Portuguese	0	0	1	0	0	0
Norwegian	8	4	5	1	2	2
Norwegian-Portuguese	0	0	0	0	1	0
Swede	2	2	1	1	0	0
Russian	2	0	0	1	2	1
Hawaiian	78	6	17	0	17	0
Caucasian-Hawaiian	130	19	18	4	19	3
Chinese Hawaiian	15	1	1	0	2	0
Portuguese	194	6	15	3	17	3
Mexican-Portuguese	1	0	0	0	0	0
Spanish	10	0	4	0	1	0
Indian-Spanish	1	0	0	0	0	0
Porto-Rican	15	0	0	0	1	0
Chinese	6	1	1	0	0	0
Chinese-American	1	0	0	0	0	0
Japanese	2	1	1	0	0	0
Korean	0	0	0	0	1	0
Filipino	4	1	2	0	1	2
Other nationalities	1	3	0	1	1	3

man who marries an Englishwoman is more likely (all other factors being equal) to perpetuate the most desirable traits and traditions of his people. The large "half-white" population that has sprung up wherever the white man has gone among dark-skinned peoples testifies to the enormous squandering of the hereditary physical, psychic, and racial traits of the North European.

The author's mature conclusion, after a decade of intensive observation in Hawaii's microcosmic melting-pot, is that biological race mingling is desirable only when it is identified with *normal Christian home life,* and only when the contracting parties are *superior specimens* of their respective racial types. Most biologic race-mingling, throughout all history, has occurred under conditions which have heavily discounted the eugenic value of such mingling.

WHAT GENETICS IS

"An exact determination of the laws of heredity," says William Bateson, "will probably work more change in man's outlook on the world, and in his power over nature, than any other advance in natural knowledge that can be clearly foreseen."

To gain this knowledge is the object of the science of genetics, which proceeds, in practice, largely by means of plant breeding and animal breeding for the reason that heredity is less complicated in these organisms than in Man, and its operation can be more easily made out. The knowledge so gained finds its application in methods for the improvement of cultivated plants and domesticated animals and, most important of all, in the improvement of the human race through the science of eugenics, which was defined by its founder, Francis Galton, as "the study of agencies under social control that may improve or impair the racial qualities of future generations, either physically or mentally."

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